The Will to Succeed Will Grow and Breed

THERE have been some misgivings annunciated by timid souls as to whether 1934 will be a better business year than 1933. After a careful check up of all the factors available to date, we are of the opinion that 1934 will be a winner.

The high signs are with us.

Business has got some substantial body to it. It has done a constitutional right-about-face. Its appetite has returned; it is living and vibrant again; it has moved a long way from the lean and emaciated form of 1932.

Of course, all the barometric and statistical readings are not conclusive enough to give one a genuine long-time forecast of optimism. They seldom do. However, the business readings are not such bad reading as the timid souls would have us believe.

Let's look at the so-called discouraging factors:

During the month of May we were forced to admit that we are facing the worst drouth on record in the wheat and small grain producing states of the country. However, all authorities concur in the prediction that we shall raise enough wheat and grain to feed us all and have a bit left over, especially when we keep in mind the 250 million bushels carried over from last year's wheat crop. The worst we have heard of the drought calamity was the remark of a Missouri wag who said it looked to him as though God had gone democratic out in the Dakotas and Minnesota. Some of Kansas and Nebraska seems to be similarly affected also, yet in the end, the drought and the A. A. A. co-operating may ultimately solve the overproduction problem for the farmer and that would be a handsome asset to the 1934 agrarian operations.

Then there are strikes and rumors of strikes, all heavily headlined and played up as national disasters in the making. Well, strikes are always settled. The textile strike of 300,000 has been settled. The projected steel strike may turn out to be a dud (not forgetting that we've had some bad ones in the past). The Auto-Lite strike at Toledo is a thing of the past, and the auto companies are offering new cars at lower prices already.

Then there was the play up of the seasonal slump and dullness of summer, about to slow things down. But in spite of all these "croaks" the month of May, 1934, was way ahead of May, 1933, and that's the fifth month of the 1934 calendar to return plus signs.

Look at some of the May figures—only a few available at this date. The leading mail order and chain store company did 30.6 per cent increase in May, 1934, over the same month a year ago.

The department stores of the country are estimating a 5 per cent increase over May, 1933.

Freight car loadings and railroad earnings are on the up and up.

There is more money available for investment; more ready credit also than the nation knows how to employ; more steady employment; more payrolls; (the strikes prove that); a resumption of building; more equipment being bought; more stability to commerce and more expansion in trade.

But to us all the above are but mere incidents. Two big factors of major importance loom larger in our mind's eye, as factors upon which sure dependence may be hung for 1934 betterment.

First, we cite the absence of speculative buying and speculative operations. The wholesome elimination of speculation as a medium for gain in industry,

trade and commerce is a factor of prime consequence to this country's stable prosperity. To cut out the gradients of business ups and downs; to shun the peaks and avoid the depths, to move our trade and commerce over a more level route throughout the year—that, to our way of thinking, is a vital desideratum and toward that method of progress it seems we are rapidly tending.

Finally, there is a finer, fairer, fighting spirit manifested more and more in our business manhood. Our business men are thinking again. They are working from the neck up. The brain trusters have made a most excellent contribution to our recovery. Those thinkers are a whole bunch of tugwells. They have worked their brains so hard and so persistently tugging this business of ours out of the doldrums, that their example has become infectious, and some of their nostrums have become so scandalous that it has fired the brains of all the rest of us. We are no longer satisfied to be led about by the nose. We also have brains and have put them to work. The business brains of the country are alive and awake. They propose to fight the recovery through.

That's what we pin our faith upon for a better 1934 business. The will to succeed will grow and breed.

Leaders of Tomorrow

COMMENCEMENT time is here again. For many it is the focal point of hopes and ambitions that have been cherished and nourished from early childhood. They have looked forward to the day when they would be able to blaze the trail and make a place for themselves in the affairs of men.

Now they have received the rudiments of an education and are anxious to try their wings. Some will be ill-prepared while others will have obtained the best in the way of education that our outstanding schools and colleges afford.

There will be those who will choose the field of pulp and paper making, an industry which to them holds out a promise for successful living. Is it going to be possible for each of them to make contact for the initial tryout?

Without the contact the individual might not be able to win his spurs—certainly a disappointment to him, but a possible loss to an organization in position to utilize his service and yet delinquent in so doing because the neophyte might have the makings of a real leader. Should he be tried and found wanting, it would be an expense to be sure, but not such an expense as might be incurred through the lack of proper consideration of his credentials. It must be realized that the leaders of tomorrow will be found among the youth of today.

Therefore, simply as a suggestion, when a young man imbued with the spirit of accomplishment makes application for employment, do not turn him away lightly. Determine his qualifications and weigh them carefully. They might be found to just balance some situation with which you have been concerned and he might prove to be a diamond in the rough.

Give him a chance.

A Century of Progress in 1934

A CENTURY OF PROGRESS, that magic recreational city and mecca of knowledge on the shore of Lake Michigan in Chicago, has again come to life, and day after day record-breaking throngs of people overflow the exposition buildings and wander through the picturesque grounds.

Those who had the opportunity of visiting the exposition last summer will never forget the spectacle of scientific wonders, the portrayal of industry's achievement, and the beauteous vision of artistic triumph that greeted them. Even a brief visit left one with rare memories.

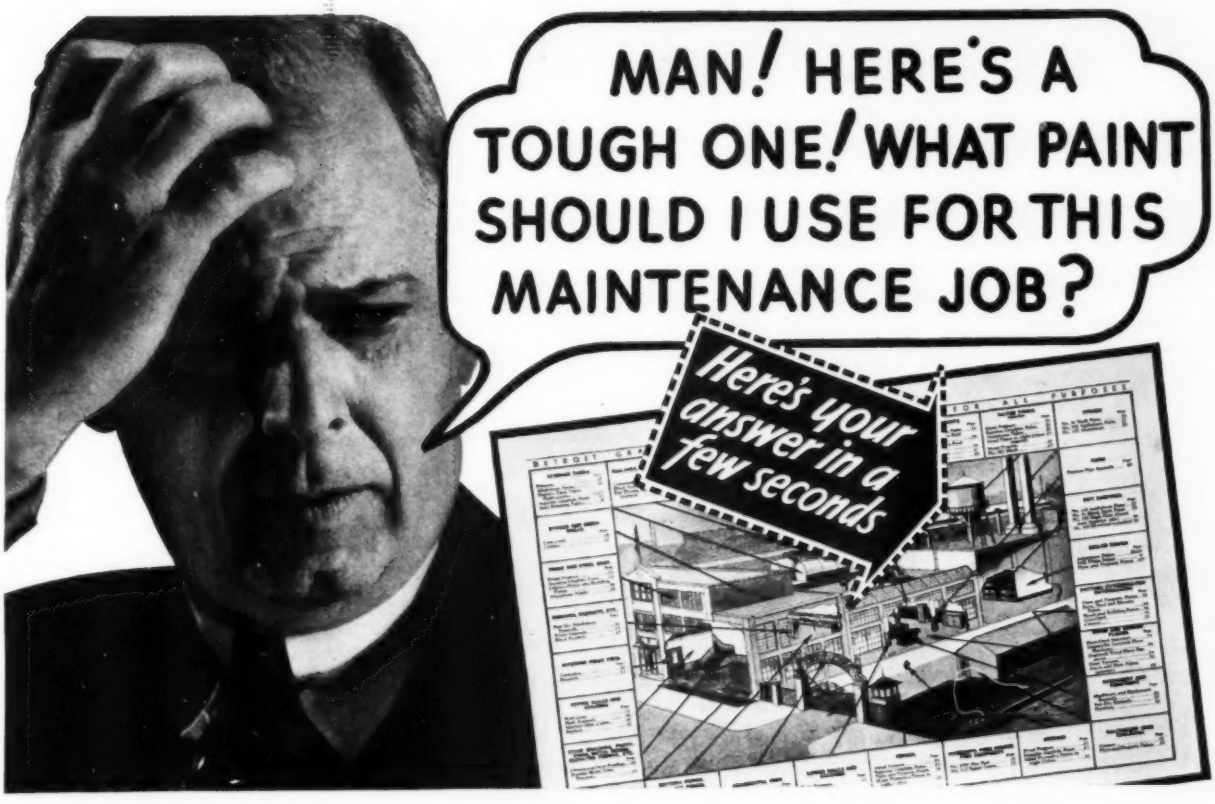
For those who will be fortunate enough to return this year and for many who have yet to experience the thrill of a visit to the exposition, many new wonders are in store. There is a complete new color scheme, greatly enlarged and varied new lighting effects and an important re-arrangement of the grounds to make room for new buildings.

Of the new exhibits, the Ford Building is perhaps the largest. In the great central rotunda of this building is the largest photo mural ever made. It is nearly 600 feet long and 20 feet high. This mural reflects the central theme of the Fair—progress. At the Louisiana Purchase Exposition in St. Louis in 1904, the largest single photograph taken up to that time was shown. It was only ten feet long and two feet high.

Another new attraction is a series of foreign villages now located on the site of the Midway of 1933. These villages are providing not only entertainment for the crowds, but have brought a historic atmosphere into the heart of the exposition.

Those who enjoy the carnival spirit of the Midway, will find that whirl of merry-makers moved to the Northerly Island. Many new and breath-taking attractions are there too.

The management of the exposition wishes it emphasized that the essential spirit of A Century of Progress will be preserved during the 1934 Fair. The theme and purpose are unchanged. Exhibits will tell the story of industry's indebtedness to science and the methods by which mankind is provided with comforts and conveniences that were undreamed of a hundred years ago.



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Ordinary mill whites start to turn yellow in a short time because the oil in them yellows with age. Degraco has perfected a mill white, called "Sta-White," made a special way with special oil that stays clear even after ten years and more on the wall. It can be washed or brushed without injury, so walls stay white. Even under the most difficult conditions it will not crack, flake or peel. It often lasts two or three times as long as ordinary mill whites, so cuts painting costs amazingly. Write today for prices and complete details of this or any other type paint you need.

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That Vacation

By WILLIAM SIBLEY

ONE balmy day in the spring, Bob said he needed a vacation and I said so did I. Bob said he was thoroughly tired out and I said so was I. He said he was just itching to go somewhere—anywhere—so long as it was away from the mill, and I said so was I. . . . We agreed then and there on a trip to Chicago and the World's Fair, as soon as we could get away.

When the time drew near, it seemed I had too much to do, so I postponed departure from week to week.

Finally Bob got serious. "Look here," he said, "I need a change and I'm going. I'm no paper mill beater. You can do as you please. But one time you wrote a magazine article entitled: This World Is Made for Well People in which you proved that the man who neglects taking vacations is worse than foolish. He's ignorant and stupid. You can buy new parts for your car but not for the human body. No matter how serious business may be, a vacation will help conquer the problems that vex you most. . . . That was your article and I believed it. And I'm going to follow your own advice. I'm sorry you're not good enough doctor to take your own medicine."

So I decided to start the following week.

But I was tempted to further delay. For one thing, the weather had been so unseasonably hot that the contemplation of travel lacked its usual allure. Maybe we couldn't get good hotel rooms and we'd have to stop at a stuffy so-called residential apartment. It seemed easier to keep on working, going home at night for a swim and a chance to relax. Besides, this nation-wide drought might lead the country into a national food shortage.

A much more potent reason for delay, however, was that we were approaching an era of Commerce by Codes. No one knew what would happen to business next month.

On top of that, I had too many irons in the fire. Too many things in work, too many loose ends, too many bills unpaid, too many sales to see through. In short, I couldn't think of anything except work and business. Thus, doubts be-deviled me; made me reluctant to start. Then, when I had all but convinced myself that I couldn't get away, I had a little note from Bob. He wrote: "A donkey engine doesn't represent a big investment, but I stopped and watched one work yesterday. It was old, almost ready for the junk heap. The man who was running it told me they would scrap it at the end of this month. But he took care to oil it, clean and cool it, just as carefully as if it were brand new. I remarked to him about that and he replied: 'Sure. . . . Why not? So long as it can be used, it's worth taking care of.'"

I got the point. I wrote Bob that I would go the following day, and so, still reluctantly and very doubtful whether I'd enjoy the vacation with business all messed up, I prepared to leave for Chicago.

. . . . . .

Monday—How quickly the mood changes. It's been two days since I left the ringing of telephones, the routine of paper work, the rut of constant concentration. It is two o'clock in the morning in my eighteenth-floor room in a loop hotel. And what I have seen yesterday and today is just nobody's business! I thought I saw the Fair last year, when I spent two days inside the gates—but I find that I just "hadn't seen nothin' yet."

Yesterday we did all the light and frivolous things. The boob-traps on the Midway. We went prepared to be taken in—wanted to be taken in—and were. Bob and I played like a couple of grade-school boys. And curiously enough, one doesn't think very much about tariff on foreign pulp when one is whizzing around and down a dizzy bend of the roller-coaster, and one doesn't dwell very heavily on codes when one is seemingly, if not actually, seven thousand miles away in some "foreign village."

Today Bob and I took in the Hall of Science. There is enough in that one building to last a man a life time. I never realized I knew so little. Bob and I stood in front of one of those scientific exhibits and watched it for over an hour. Perfectly marvelous how those engineers and scientists have spelled out, into layman's language, the intricacies of chemistry and physics. . . . We also went up to the Ford Building. And what a job Henry has done! That man is smart. At least smart enough to know it is smart to spend money for brains.

Wednesday—Two more days away from that mill and all its troubles. And Bob and I have seen so much—and walked so far—and eaten so many hamburgers—and listened to so many symphony concerts—and seen so many sights—that for once I am just overwhelmed into silence. I wonder what Mac, my superintendent would think if he saw me "overwhelmed into silence!"

Saturday—My week has flown and I am more reluctant to start home tomorrow than I had been to come. I laugh as I recall how I had thought I couldn't get away even for a week. . . . I found a sheet of paper in one of my coat pockets labeled "Work Docket." Already certain items seem unessential, certain others that had seemed complicated now appear simple, while a number of new ideas, chiefly gained from the Fair, are pushing up their heads. Just a single little week—but what a difference in perspective and energy!!

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THE PAPER INDUSTRY

A MONTHLY EDUCATIONAL JOURNAL

Top Sergeant Methods in Business Are Antiquated

By J. M. CONWAY, President
Hoberg Paper and Fibre Company

HISTORY has an interesting disregard for time measurements. The changes we have had in our political and economic life have not come to us at stated intervals. They have come like a burst of sunshine or the fury of a storm. No one has accurately set the day and year for their coming.

It is after things have happened that you and I add the changes to our record and either profit from the lessons they bring us or disregard them to our own discomfort in the future.

Political leaders and economic leaders have been floundering about for the last four years trying to adjust themselves to the havoc that arrived with that historic crash which overwhelmed us in 1929, and most of us are still very much at sea as to the future.

We do know, however, that another epoch has opened and that all of us must make new adjustments and prepare ourselves for change. The individual who has adaptability and capacity sufficient to cast off worn-out methods and procedures will move from the epoch just closed into the new with comparative ease. The hard boiled conservative who lives completely in the past will undoubtedly go under.

Business management has an interesting history. The few historians who have attempted to record it have not been very successful. It takes business men to write business history, and the average business man has been so completely absorbed in the present that he seldom has time to delve into the past.

The business manager of a century ago would be lost in the maze of movement that confronts his descendant of 1934, even though we discount completely the problems brought to us by the late depression. The small industries of his day were family units. They had limited markets, limited outputs and but few employees other than members of his immediate family. His ability as a craftsman gave him his rating.

Industrial history in the United States opens with the introduction of textile manufacturing in New England. This was followed by the growth of the steel, paper, lumber and the diversification that marks business of today.

Manual skill gave way to machine skill and machine skill called for more men and greater markets. The business man or the industrialist was no longer able to either keep every function of his business in his own hands or in the hands of his family.

He was forced to delegate most of these functions to others and ability to select and train men became a task more important to him than mere ability to use brain and hands in producing a product for the market.

Year after year the business manager shifted more business and industrial details from his own hands to the hands of subordinates, and today we have a paradox presented in the form of lawyers managing railroad systems, bankers operating industries, and men or women, whose training charted them for specialized lines, leading great organizations of individuals in vocations far removed from those fields they had at one time expected to explore.

The answer to all of this is simple. These men and women were students of human nature. They learned to read life and living. They were essentially human,

and because they were human, they were enabled to appreciate the limitations of people around him.

Today we hear much about regimentation of industry and business. We do not want it. We feel that the plan is against the very ideals of our American people; that it is undemocratic, and that it cannot and will not be accepted by Americans who have practiced individualism for over 150 years.

Business managers in particular are very much wrought up over the proposal, and I feel that their concern is not without justification.

But as a business manager I am just as much concerned with *regimentation in industry* as I am with *regimentation of industry*. I am concerned over the domination of much of our industry by men who will accept no curb on their own individualism as industrialists but who demand that the men in their industry lose all of their individualism and follow an inflexible program laid out for them by the business manager himself.

I fear that this type of business manager is going to have hard going in the epoch that has just opened to us. I am afraid that if regimentation of industry and business does come to us, he will be the direct cause of it and that he must mend his ways if he is to avoid it.

Some one has said that the best government is the one which rests the lightest upon its people. I believe that the best business manager is the man who governs his business with the smallest possible restraint upon those employed in his business.

I believe, moreover, that the business manager who recognizes and accepts the initiative of every individual in his employ is the one who will have the greatest ultimate success and who will best meet the trials of the epoch that is just opening in industry.

One of the largest industries in this country decided to engage in the production of electric refrigerators. Its engineers designed an exceptional unit which operated beautifully under certain conditions. Under other conditions the unit was a failure. One element to overcome this failure was required and some of the best engineers in the country were brought in to labor without results over a period of three months.

This industry recognized and respected the initiative of its employees and ideas offered by employees were carefully considered. One day a minor employee proposed a very simple remedy for the faulty refrigerator. It was tried and worked perfectly. The man was rewarded for his suggestion. It is safe to venture that today every man or woman employed by that industry is endeavoring to find methods and means for the improvement of the product they are turning out.

The day of "Top Sergeant" methods in business and industrial management is gone. The great calamity in our business life is that we ever tolerated it. It is possible that much of our present trouble can be traced directly to the fact that we did use army methods and did regiment those whom we employed.

A business man of my acquaintance was forced to go to Florida one winter because of his failing health. He had never previously left his office during his busy season. He asked his department heads to send him daily reports on the progress of his plant while he was gone.

He expected the worst and looked for all manner of complications during his absence. He was very much disappointed to find that during his absence his organization had one of the best seasons in its history.

He mentioned this fact to a friend, and the friend said, "Man, you ought to feel proud of yourself. You picked good men, trained them well and their success is a real compliment to you as a business manager." This man returned to his business completely satisfied. He has given more responsibility to his men. He has been surprised to have them tell him of a dozen methods that might be used to good advantage in building up a better business. Today he leaves his office for a week with no worries and no cares.

This world is filled with men and women who are capable. It is filled with people who are waiting for an opportunity to demonstrate their capability.

They cannot be employed in the same manner that you or I would purchase a piece of machinery. They are not machines because they are animated with the same desire for success and advancement that animates you and me.

The epoch that has just opened is going to offer greater opportunity for these men and these women. It is going to offer greater opportunity for those who employ them.

The business manager who manages with moderation, who uses the brains rather than the brawn of those he employs, is going to enter this new epoch without fear of the future.

It therefore behooves each and every one of those who employs or uses the human factor in producing or selling goods, to brush up on human relations, to take a course in reading human nature—in other words, to put himself or herself in the shoes of the individual employed.

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Industrial Uses of Color Charts

Extensive use of various forms of charts as standards for color in specification of commodities is revealed by the Bureau of Standards Letter Circular No. 358, "Color Charts." This consists of brief descriptions of the charts and purposes for which they are used. The U. S. Army uses rectangles of silk as color standards for textiles, and colored paper cards as standards for paint, in the purchase of these materials. Colored cards are used by the Bureau of Aeronauties as standards for finishing material for aircraft. As a part of standardization of their products effected in co-operation with the Bureau of Standards, the school furniture industry adopted stained blocks of wood for color standards, and the sanitary ware industry adopted vitreous color standards. Very extensive systems of color charts for general use have been published and are widely used for specification of color. The textile and allied industries have adopted "Standard and Seasonal Color Cards" in which silk is used for the standards. Despite the important part color plays in the paper industry, little effort has been made to standardize paper colors. It would seem that the use of standard color charts by the paper industry, rather than the present practice of matching samples submitted with orders, would lead to economy and the better satisfaction of all concerned.

Color Analysis and Specification

By JOSEPH RAZEK, Ph. D. Department of Physics
University of Pennsylvania

COLOR measurement, owing to the number of factors which must be recognized and individually analyzed, presents a problem of considerable difficulty. It is a problem that has received the attention of physicists from the time of Sir Isaac Newton, but even today there are many points about it which are still controversial. So much depends upon whether a procedure to obtain reproducible results or a general theory to explain all the psychophysical factors is the ultimate aim.

Walsh in his book on *Photometry* states that "Color is the psychological sensation resulting from the physiological action produced on the retina by that physical property of light waves which is called the frequency." Such a definition brings out clearly the three different aspects of the problem, which, while inter-related, must be separately analyzed. The psychological and physiological aspects are only partly understood. They are difficult of measurement and evaluation, and must be dealt with more or less empirically. The physical aspect on the other hand is much simpler and lends itself to rigorous definition and measurement.

It is obvious that color is the result of light energy. Light energy comes from various sources, such as the sun, and to a much lesser extent, the other heavenly bodies; and from such luminous sources as incandescent materials. The great diversity in character of these various sources is due to the difference in frequency distribution of the vibrations associated with the energy.

If a narrow beam of sunlight, or light from an incandescent solid, is passed through a triangular glass prism, it will spread out into a band which exhibits different colors from one end to the other. Violet, blue, green, yellow, orange and red shade into one another by imperceptible degrees. When these components are reversed through the prism in proper intensity and space relation, it is actually possible to obtain the original white light.

If light from a glowing gas, such as mercury vapor, electrically excited, is similarly handled, a totally different effect is observed. Instead of a continuous band of color, only a few bright lines are seen. The color of each of these lines corresponds exactly to the color which was seen in the continuous spectrum at that same point, but the spaces between the lines are entirely dark. Close examination will reveal that the light from the mercury arc consists almost entirely of three kinds of violet light, a little blue, some green and some yellow light. Physicists have shown conclusively that each of these colors has associated with it a definite and accurately measureable wave length. For example, the brighter lines of the mercury spectrum, measured in millimicrons, or millionths of millimeters, are found to have the following wave lengths: violet lines 405,408, and 435; blue line 492; green 546; and yellow 577 and 579.

Every element when properly excited will give its particular spectrum, and chemists are able to detect the presence of elements by means of these spectra. Since these lines exhibit the same color as the continuous spectrum at the same point, it is possible to use the wave lengths as reference points for the various colors. The visible range of the continuous spectrum is from about 400 millimicrons at the violet end to about 700 millimicrons at the red end. As a ready rule, the color scale can be subdivided as follows: violet 450; blue 500; green 540; yellow 580; orange 600; and red 660 millimicrons. It may be noted that the specification of a color by wave length is exactly analogous to the specification of a musical sound by pitch.

The paper technologist is particularly interested in the color of opaque objects. In this instance, the light which gives the sensation of color comes from the object in question by reflection; that is, light energy from some luminous source strikes the object and is more or less selectively reflected from it. Therefore, the color of such an object is actually dependent not only on how it reflects the light, but on the color of the incident light.

For example: If a blue card is held in the blue part of the continuous spectrum, it appears a bright blue; but if it is held in the red part, the card appears nearly black. This shows that the blue card reflects blue light very strongly, but the red light very little. Conversely, a red card will appear black when illuminated with blue light, but bright red when illuminated with red light. Hence, the color of an opaque object is determined by the light which it reflects, since when illuminated by a mixture of all colors, as are most ordinary illuminants, the object will reflect some and absorb the others.

Now, the so-called white object will reflect all colored light with equal facility. If it reflects only a small portion, the color is called gray, and if none at all is reflected, the color is called black.

It is possible to state precisely the color of an opaque object by stating how much of each color it will reflect. For example, a freshly scraped surface of a block of magnesium carbonate, a white substance readily obtainable in a reasonably pure state, will reflect a large proportion of the light falling upon it in all directions. The block will appear white since it will reflect all the component colors with equal facility when illuminated by white light. If light of a definite wave length and intensity is allowed to fall upon such a block, a certain amount of this light will be diffusely reflected. If the same light is allowed to fall upon an object whose color it is desired to specify, a different and smaller amount of light will be reflected. The ratio of the amount of light reflected by the object to the amount of light of the same color reflected by the magnesium carbonate, the incident light being equal in both cases, is known as the reflection factor or reflectance. This process can be repeated with a number of wave lengths, extending through the spectrum and the reflection factor obtained at each wave length. Better still, if the ratio can be obtained while the wave length changes continuously, a reflection factor curve can be obtained.

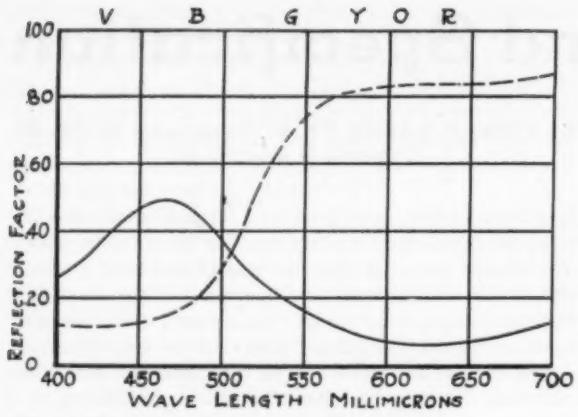

Fig. 1—Reflection factor curves. The solid line is the curve for a blue card, the dotted line the curve for a yellow card

Two such curves are shown in Figure 1, which are the reflection factor curves for a blue and yellow card, respectively.

In the case of transparent objects, an exactly analogous procedure can be followed, except that the light transmitted by the object is measured instead of the light reflected from it. In this case, a curve of transmission factor and wave length results.

The reflection factor curve plotted against wave length is a unique specification of the objective color; that is, if two substances have identical reflection factor curves, their color must be identical. Another way to look at this it to note that obtaining the reflection factor curves of two objects is analogous to examining them repeatedly in all colors of light. If the two objects exhibit the same color when examined under all colors of light sucessively, they must be identical when examined under any mixture of colored lights. However, the converse is unfortunately not true. It is possible to have two objects appear identical under certain forms of illumination and have somewhat different reflection factor curves.

When an object, oriented more or less at random, is examined, the light entering the eye, in general is made up of two parts: light from the primary source reflected from the object specularly, and light reflected from the object diffusely. The former depends almost entirely on the surface conditions of the object, and the angular relationship between the primary source, the object and the eye. The light diffusely reflected is influenced by the same factors to some extent, more in the case of objects having much surface structure, but it is usually more dependent on the body color than on surface conditions. This is especially true if the conditions of illumination are definitely specified and held constant, as must be done if the numerical values are to mean anything.

Data from which reflection factor curves can be plotted are obtained by means of instruments known as spectrophotometers. All of these instruments consist fundamentally of some means for dispersing light from some source of continuous radiation, and some means for determining the fraction of the light of the given color which is reflected from the sample or transmitted in the case of a transparent sample.

Spectrophotometers are divided roughly into two classes—the visual type and the photoelectric type. The Keuffel and Esser Color Analyzer[1] is an example of the visual type with which readings are obtained by visually matching two sides of a colored field for brightness. Three types of photoelectric spectrophotometers, a more recent development, are available at this time. One of them, the G. E. recording color analyzer, is an automatic curve drawing spectrophotometer, developed by Professor Arthur C. Hardy, at the Massachusetts Institute of Technology.[2] Another is the semi-automatic instrument developed by the American Photoelectric Corporation. This instrument must be set point by point, and the resulting data plotted manually. The third type, shown in Figure 2, is the Razek-Mulder Color Analyzer, developed in the Department of Physics of the University of Pennsylvania. This instrument is a completely automatic spectrophotometer in which the curve of reflectance against wave length is recorded on a photographic film. The instrument is described in detail in a paper by Jackson Burgess, read before T. A. P. P. I. in September 1930 at Erie, Pa. More recently, it was described by Messrs. Hatch and Hauff, in the Paper Trade Journal.[3]

The development of these automatic spectrophotometers has greatly facilitated industrial color analysis. With these new instruments the actual obtaining of the data is simple and rapid, so that more time is available for the actual interpretation of results.

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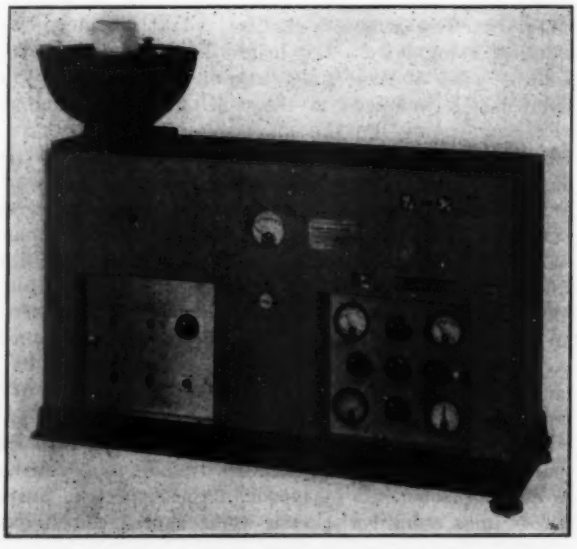

Fig. 2—The Razek-Mulder Color Analyzer. The sample to be tested is placed on the hemispherical illuminating unit at the left. Turning the small crank in the lower right hand corner causes different portions of the spectrum of the light reflected from the sample to be admitted to the photoelectric cell. The amplified output of the latter operates a galvanometer, the indication of which can be observed on the visual scale in front and recorded on a moving film. The identification number set in the upper right hand corner and the co-ordinates are automatically printed on the film. The complete operation for recording an analysis takes about 30 seconds.

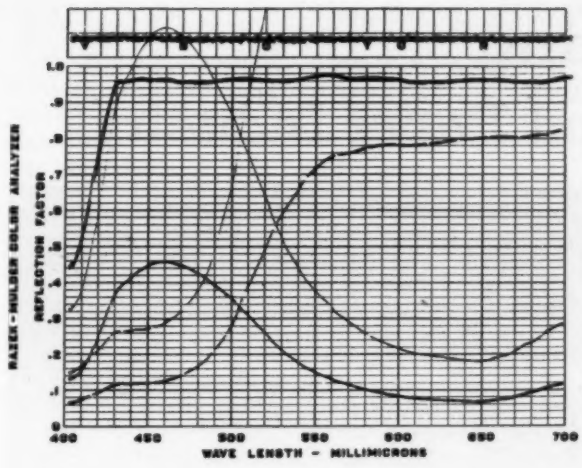

Fig. 3—Reproduction of color analysis film made on Razek-Mulder Color Analyzer. The curves shown in Fig. 1 were plotted from this film. The uppermost curve is the record of the illumination unit voltage. The curve around 0.96 is the trace for the standard white magnesium carbonate, run twice, once at beginning and again at end of test. Solid line, record for blue card. Dotted line, record for yellow card. The light curves approximately parallel to the others are the corresponding curves with all ordinates multiplied by 2½ to facilitate reading of low values. The reflection factor at a given wave length is obtained by dividing the ordinate for the curve at that wave length by the ordinate for the standard white at the same wave length.

◆ ◆

The actual problem of physical color analysis is completed with the drawing of the reflection factor curve. Direct inspection of the curve for two different samples will show just wherein they differ. Furthermore, the curve is an indestructible and permanent record of the color of the sample, not affected by the many changes to which all colored objects are more or less subject.

As stated before, two samples having identical reflection factor curves will be identical (neglecting differences due to surface conditions) under any and all types of illumination. Sometimes, however, two samples will have curves differing somewhat, and yet appear identical under some forms of illumination. In addition, the difference between two reflection factor curves is only roughly a measure of the actual visual difference between the samples. To obtain a more compact answer than that given by a curve, the psychophysical factors affecting the visual mechanism must be involved.

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1. Gardner, *The Physical and Chemical Examination of Paints, Varnishes and Colors*, Fifth Ed. p. 212.
2. Hardy and Perrin, *The Principles of Optics*, p. 287.
3. R. S. Hatch and H. A. Hauff, The Razek-Mulder Color Analyzer and its Use for the Measurement of Pulp and Paper Color, *Paper Trade Journal*, Dec. 28, 1933.

The remainder of Dr. Razek's article will be published in an early issue of this magazine.

What Is Technical Control . . . and Does It Pay?

By JOHN BELLOWS

THE phrase *technical control* sounds rather theoretical to the practical operating man. If, however, we break it up into what it basically means we find it simple and practical.

Technical Control as applied to pulp and paper manufacturing should seek to accomplish the following:

1—Analysis and evaluation of raw materials with regard to their suitability and economy for the process intended.

2—Through research and a careful study of existing conditions develop standard procedures for the various manufacturing processes.

3—Control of these processes to insure:—

(a) Uniform quality of the finished product.

(b) Economic operation.

4—Development of standard specifications for the finished product.

5—Analysis and evaluation of the finished product to determine if it meets the standard specifications.

The majority of practical pulp and paper makers believe that a certain amount of technical control is necessary and beneficial. How much should be spent on technical control and what parts of the process should be technically controlled is a question for each mill to decide, depending on its tonnage, type of product produced, nature of process, selling price and what the competitive requirements are.

Too much technical control is almost as bad as not enough. There are places in every process where too much technical control does not pay. Providing quality is not materially affected it is not economy to pay fifty cents a ton to technically control a part of the process where the greatest possible saving from such control could be only twenty-five cents a ton. There are many places in the process of making pulp and paper where it is impossible to measure in terms of dollars and cents what are the benefits derived from technical control. What should be guarded against is too much technical control just for the sake of technical control. The average mill has had to curtail its technical program the last few years. Some have been able to keep the same technical forces that they had before the depression. All should be able to say that their technical control program pays dividends in either improved quality, reduced costs, new business or a combination of all three.

Chromium Plating
in the Pulp and Paper Industry

Chromium-plated chilled iron breaker roll, 115 inches long and 16 inches in diameter, weight 5500 lb. Ground before and after plating, also polished after plating

By D. H. BISSELL, Assistant Treasurer
Chromium Corporation of America

FOR more than a century chromium has played an important part in resisting wear and corrosion by imparting its remarkable hardness and corrosion-resisting characteristics to other metals. Since its discovery by Vauquelin in 1797, it has been used principally in the manufacture of alloy steels, which derive their more important advantages from their chromium content. The art of commercially electroplating chromium was not perfected until about 1925 and then only after overcoming many difficulties which hampered its practical use. Despite intensive research its utility was insignificant until Bunsen first electroplated chromium in 1854. After an interval of some 70 years, the experiments of Fink and others developed electroplating of chromium to a point where it became an instrument of almost unlimited value to industry. In these and succeeding efforts the co-operation of manufacturers and users—most essential in development work of this nature—was readily given.

The most outstanding service rendered by industrial chromium plating is protection against wear and corrosion. The correct deposition of chromium plate upon any metallic surface materially increases its hardness. This hardest of commercial metals is nine-tenths as hard as the diamond and more than twice as hard as ordinary steel. The degree of hardness of a chromium-plated surface is largely governed by the corresponding structure of the base metal as well as by methods followed in cleaning and plating procedure. Electroplated chromium varies widely in this attribute. Tests made in England indicated a variation in Brinell hardness of from 500 to 900, and these fluctuations explain some failures to attain increased wear from chromium-plated parts. Actual plating technique is probably the most influential factor in the success of the application.

Characteristics of Chromium

Chromium itself never corrodes: its coefficients of expansion and friction are low and its melting point high (2700 deg. Fahr.). It resists oxidation to 3150 deg. Fahr. Neither alkalies nor organic acids affect chromium. It is impervious to all acids except hydrochloric and, to some extent, sulphuric. Electroplated chromium possesses strong adhesive qualities and forms a perfect bond with the base metal. The extreme smoothness of chromium is another important characteristic.

These peculiar properties are of exceptional interest to the paper industry, which has its own special problems of wear and corrosion. Even aside from this protection there has been a keen interest in paper-mill applications because chromium plating of rolls and other equipment not only initially produces a higher quality of paper, but maintains it with comparatively little variation for extremely long periods. This is an important factor in mill operation, because of the present-day demand for higher quality and a more uniform grade of product. Mill operators have found it imperative to closely examine their production costs in an effort to reduce every possible item of expense, and in this chromium plate has been able to afford definite economies.

Usually, the most important advantage is the extended life of the plated part, but quite frequently this factor is of less practical importance than improved quality of product or maintained accuracy of precision equipment.

This is typified by experience with chromium plated screen plates, where the maintained accuracy of slot sizes, freedom from clogging and the use of finer slots without loss in production outweigh the advantage of extended screen plate life. There are many indirect economies which are difficult of measurement, such as avoidance of frequent replacements, lessened maintenance expense and fewer operating delays and difficulties. In the last analysis, the savings from all sources must at least equal the expense of chromium plating

in order to make the application practical, but even this is not always a true yardstick because of the element of improved quality. Those who claim that the expense of plating is disproportionately high can only make a fair comparison by taking into account the comparative performance and reducing it to a unit or cost-per-month basis.

In some quarters, it is not recognized that there is a very well-defined distinction between decorative and industrial chromium plating, both as to cost, characteristics of the plated part in its ability to resist wear and corrosion, and general performance. The technique of industrial chromium plating is fundamentally different from that employed for decorative work. The ineffectual performance of decorative plating applied for industrial purposes creates an erroneous impression of the ability of authentic industrial applications to deliver the performance claimed for them. Manufacturers and users of equipment lack specifications for a standard chromium plate because such standards are impossible to precisely define. A serviceable plate for a specific purpose may be useless for another which involves different requirements. Differences of opinion exist as to the practicability of various cleaning and plating methods, thickness of deposits and other variables, but regardless of these divergent opinions it is essential that a careful study be made of the problem in hand. It is preferable to choose a reliable plating organization, taking full advantage of its technical knowledge and practical experience surrounding similar applications. Disappointing experiences in industrial chromium plating have caused too quick condemnation—many such troubles might never have materialized had a reesponsible and experienced plating organization been consulted. In the last analysis, the purchaser of chromium plating service must have confidence in the ability of the organization serving him, and it in turn must fall back upon the results of its research activities, teechnical knowledge, experience and facilities. Few organizations are equipped to this extent, but those who are can supply reliable data and provide a service which brings out to the greatest possible extent the finest qualities of chromium plate.

The situation regarding standard specifications is similar to that with respect to the cost of chromium plating. This is affected by too many variable factors to permit much uniformity. The principal factors involved are the weight, shape and size of the part; the base metal and its condition; the number of similar pieces to be plated; and the object and requirements of the application. Chromium plating is largely a question of labor and expert tehenical supervision. It is ordinarily found that the use of a particular metal is most advantageous for the construction of a given part, but if chromium plate is used, the parts may be made of a cheaper material capable of being easily machined and chromium-plated. Advocates of alloy steels (which sometimes offer forming and fabricating difficulties and are usually expensive) stress the fact that the solid metal is positive insurance against chipping or cracking of the surface. It should be recognized that these troubles are not experienced with chromium-plated parts if the cleaning and plating is properly done, and if the plated piece is not subjected to extremely severe punishment. The practicability of the alloy steels is unquestionable, but chromium plating in many instances achieves equal or better results at less cost.

Plating Applications and Resultant Economies

One of the most successful applications in the paper industry is on flat and curved screen plates. Aside from the longer useful life of the plates themselves, the correct deposition of chromium on the surfaces and inside the slots tends to eliminate stringing and clogging. It not only permits the use of fine slots but also preserves the essential accuracy of slot size. The non-adherent nature of a chromium-plated surface prevents, to a large extent, the filling up of slots, which has been reported to cause as much as 40 per cent loss in screening capacity within one week's operation. This same characteristic of smoothness often permits the adoption of finer slot sizes with consequent improved paper quality and lowered dirt count without the

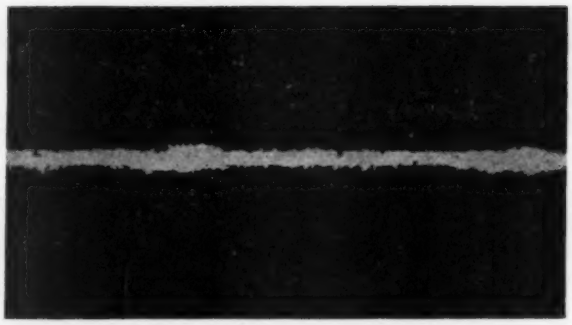
Chromium-plated cast iron drying drum, 102 inches long and 48 inches in diameter; weight, 9000 lb.

Chromium-plated forged steel sizing press roll, 121-in. face and 56¾-inch circumference; weight, 8000 lb.

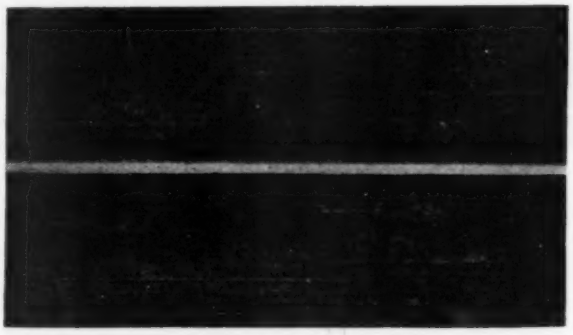
usually attendant loss in production. This does not mean that forced velocity is necessary, because chromium-plated plates normally deliver larger daily production than unplated plates of identical slot size, or the slots can be somewhat reduced without slowing up output. Another factor of some economy is the freedom from cleaning, but of more importance is the maintained accuracy of the slot sizes. A mill which has used several hundred plated screen plates over a period of years has obtained an average of four times normal plate life. Another reports impereceptible wear after fourteen months of service. After having been in use eight months other chromium-plated plates were found to be in perfect condition, but the slots of unplated screens installed at the same time were roughened and worn as much as .002 inch during the same period. Plated screens which have been in daily use for more than two years are apparently as perfect as the day they were installed. In another mill, unplated plates with .032-inch slots usually wore from .001 inch to .0015 inch within three months' time, depending upon the rate of operation, but chromium-plated plates under the same conditions have been in service for more than six months with no sign of wear. Tests in a board mill showed that chromium plating permitted the use of .024-inch instead of .032-inch slots without loss of capacity, notwithstanding a detrimental decrease in output from unplated plates caused by no more than .002-inch slot reduction. Within three months, unplated curved screen plates with .014-inch slots wore to .017 inch, but after more than two years' use .009-inch chromium-plated screens showed no measurable wear. This same mill has attained noticeable improvement in quality of product without loss in capacity by using .009-inch slots.

In the case of suction box covers, benefits of chromium plating arise not so much from the protection of the cover as from the materially increased life of wires or felts, due to the smoothness of plated covers. Performance records of a paper machine run from 650 to 800 feet per minute show an average increased wire life of 30 per cent. Corresponding increases in the life of felts are obtained, and due to the increased suction efficiency more moisture is removed. New developments in suction box covers have made it possible to obtain reversible metal covers, and these, chromium plated, offer further opportunities for extended useful life. Recent technical inquiries indicate that standard maple covers need to be planed once or twice a week; end-grain maple may go from one month to one year, but chromium-plated covers do not need to be touched. Apparently the consensus of opinion is in favor of end-grain maple, but those who have used chromium-plated metal covers have found them to be satisfactory even in spite of their higher initial cost.

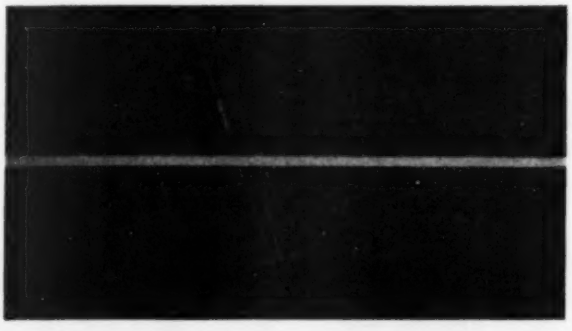
Press rolls offer another interesting application for industrial chromium plating, in which full advantage is taken of its hardness and smoothness. Plated rolls as a rule run clear and free without adherence of stock or size. Water is more readily released and cleaning operations are simplified. Savings in power of 30 per cent have been effected. Of essential importance is precision of finish and absolute smoothness. Chromium-plated rolls can be ground to absolute accuracy with or without crowns, and their long wearing characteristics preserve this precision and simplify mechanical adjustments. The advancement of plating technique has made it possible to recover worn, porous or corroded rolls; grind accurately to desired size, and chromium plate to obtain a perfect surface from which all imperfections have been removed. This is frequently less expensive than the application of a new shell, and the final results are definitely superior. Forged steel anti-deflection rolls have more recently had favorable comment. One of these, chromium plated, 20-inch diameter and 133-inch face, used as a bottom smoothing press roll, without crown, runs parallel and is free from sticking and accumulation of



Ordinary bronze screen plate after 10 months of service (magnified 10 diameters). This plate was recut twice. Note ragged edges and widening of slots as well as roughness of surface



Ordinary bronze screen plate after 3 months of service. Note rounding of slot edges (indicated by darker areas) and scoring of surface



Chromium-plated bronze screen plate after 24 months of service. Note complete preservation of slot accuracy, absence of wear of slot edges and smoothness of surface

size. A New York mill, which was never able to make ten-pound paper with unplated rolls, found that the use of a chromium-plated roll made it possible to materially reduce the pressure on the doctor blade and make thin crepe.

Chromium-plated drying drums remain clean and bright. Their smooth surfaces seldom score or pit. These rolls prevent sticking or clogging and are too hard to dent easily. The drying process is accelerated by a consistently high heat transfer efficiency. These large rolls also may be precision ground if necessary. Embossing and printing rolls have for a long time been chromium plated to prolong the life of engraved designs and protect against damage. Some mills have reported that the life of these engraved patterns have been increased many times and that the plating pereceptibly increases the sharpness of outline in printed and embossed work. One mill which wore out an embossing roll within two months found that by chromium plating this roll it would run for nearly one year.

Chest Outlets and Overflows

By O. K. GRAEF

INADEQUATE chest outlets and overflows can be avoided if proper calculations are made of the rate of discharge at the time of laying out an installation.

A pipe flange bolted to a chest surface and an opening concentric with the pipe cut beneath the flange through the chest wall is probably the most simple type of chest outlet. Obviously, such an outlet as illustrated in Fig. 1 is a square edged orifice and the pipe connected to it will not carry a full normal flow because of the loss of head at the entrance. To obtain sufficient flow from such an outlet necessitates the use of an oversized pipe for the line, or a reducer at the tank outlet to decrease the orifice losses. The size of the reducer for an outlet of this kind (Fig. 2) will depend somewhat on the length of the line. A short pipe, two to three diameters in length, will flow at about 80 per cent capacity, while the line capacity will be reduced to about 60 per cent for lengths over about 35 diameters (Fig. 3).

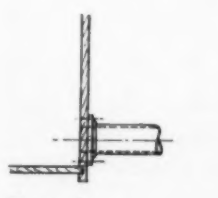


FIG. 1

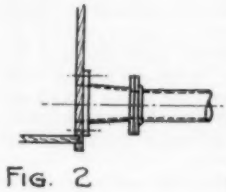


FIG. 2

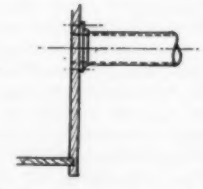


FIG. 5

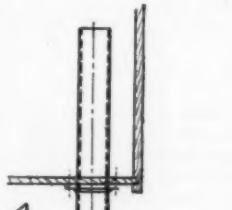


FIG. 4

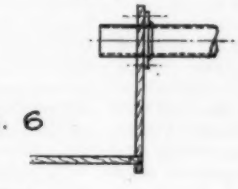


FIG. 6

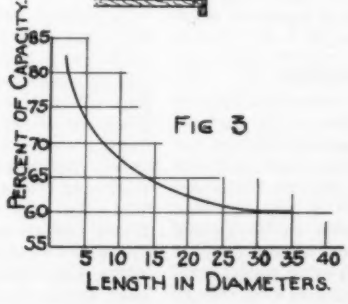


FIG 3

If a reducer is used, provided it does not increase the pipe size over 2 inches, the outflow will be 95 per cent of the normal capacity of the pipe. An increase in pipe size of 4 inches, as in a 6 x 10 reducer, allows a pipe line flow of only about 90 per cent of normal. The efficiency, of course, varies with the angle that the walls of the reducer makes with the walls of the pipe; but the figures given are sufficiently accurate for practical use on pipes up to about 16 inches in diameter. It is, therefore, a fallacy to attempt to increase flow through a line by the use of excessive oversizes on the inlet of a reducer.

For a tank overflow, where the overflow line is a vertical entrant pipe (Fig. 4), the most desirable discharge and pipe size may be calculated by the use of the formulae

$G = 10.08\ H\sqrt{H} \times d$ and $d = \frac{G}{10.08\ H\sqrt{H}}$ where G = gallons per minute discharged, H = Head or depth of water causing overflow measured in still water, and d = Diameter of pipe in inches.

The formulae—$G = 3.84d^{2.5}$ and $d = \sqrt[2.5]{\frac{G}{3.84}}$ can be used for the calculation of a side outlet overflow when the discharge entrance is flush with the chest wall (Fig. 5). Should the side outlet overflow extend within the chest as illustrated in Fig. 6, then the discharge would be reduced about 20 per cent and the formulae necessarily changed to meet this condition. Flow in either case, however, might be increased through the use of a reducer—the formulae suggested being only for orifices uniform in size with the pipe. Should a reducer be employed, the remarks relative to its use as an orifice would then naturally apply.

Structure of the Cell Wall of Wood Fibers

By GEORGE J. RITTER, Chemist
Forest Products Laboratory[1]

RECORDS of observations made by early research workers on the cell-wall structure are an inspiration to present-day workers. Although at that time the microscopes were less refined than they are today, yet in the hands of careful observers amazingly fine structures of the cell wall were reported. The discovery of the fibrils was reported by Meyer as early as 1838.[2] Stratifications in cross sections of fibers and striations on the lateral surfaces of fibers were reported in 1877[3] and in 1882.[4] In 1892, Wiesner,[5] on treating fibers with acid at elevated temperatures, obtained a fine, dustlike residue, the particles of which he named *dermatosomes*. Submicroscopic structural units were postulated in 1877 by Nageli[3] in his micelle theory which is still fundamentally sound.

During the past twelve years, several investigators have developed methods for locating the chemical constituents in the cell wall. Wood sections are treated with reagents for dissolving a given component and with the aid of a microscope the location of the remaining components in the wood residue is noted. Preliminary studies by König and Rump[6] and by Abrams[7] in this field showed the possibilities of obtaining fundamental data on the cell-wall structure. A series of papers by the Forest Products Laboratory, Lüdtke, Scarth, Harlow, Von Iterson, Trogus, Krüger, and others has furnished many confirmatory data interspersed with some of a contradictory nature.

This paper deals with: (1) the distribution of the lignin in the cell wall of wood fibers; (2) the distribution of carbohydrates in the cell wall; and (3) the microstructure of the cell wall.

Distribution of Lignin in the Cell Wall

The major portion of the lignin in wood is located in the middle lamella; the remaining portion is in the cell wall (Fig. 1). The lignin in the middle lamella forms a continuous, thin-walled medium which resembles honeycomb and which serves as a cementing substance between the wood fibers. These thin walls are characterized by thickened areas, known as tori and bars of Sanio, and thinned areas, termed pit membranes.

Lignin from the cell wall has been isolated at the Forest Products Laboratory as a finely divided amorphous material by means of 72 per cent sulphuric acid.[8] Freudenberg[9] and Harlow,[10] on the other hand, have isolated lignin from the cell wall as a fragile, porous structure. They state that on drying, the lignin residue of the cell wall shrinks against the middle-lamella lignin. This concept of the structure of the cell-wall lignin seems plausible. It is possible that the treatments used for isolating the lignin at the Forest Products Laboratory were too drastic for the fragile structure to withstand. As a result, the cell-wall lignin was obtained in a finely crumbled state.

The lignin content of the cell walls of hard-woods is less than that of soft-woods. As a result, during chemical and mechanical treatments, the cell-wall lignin in the hardwoods crumbles into a finely divided amorphous material more easily than that in the softwoods. After crumbling it can be removed by careful washing, leaving the middle-lamella lignin with no sharp lateral projections (Fig. 2). The absence of sharp projections on the middle-lamella lignin would indicate that the two types of lignin are not joined in structure as suggested by Freudenberg.[9]

When sulphuric acid is used, the amorphous lignin is mixed with partly decomposed carbaydyrates since 72 per cent sulphuric acid at temperatures from 20 deg. to 35 deg. converts hemicellulose into a material having some properties similar to those of lignin.[11] The early isolations of lignin at the Forest Products Laboratory were made without close temperature control. Consequently, the yields of cell-wall lignin as reported[8] are too high. Formation of partially charred carbohydrates can be reduced to a minimum by temperature control, but there is still no reliable method for quantitatively separating the cell-wall lignin from the middle-lamella lignin. Until such a method is developed the ratio of the two types of lignin in wood will remain unknown.

Distribution of Carbohydrates

Cross and Bevan cellulose (Figs. 3 and 4), which constitutes the bulk of the cell wall, is obtained through repeated alternate treatments of wood with chlorine gas and sulphite solution. Some of the hemicelluloses that are dissolved by this procedure seem to be located with the lignin in the middle lamella since wood fibers still cling together in a total carbohydrate residue, even though the lignin has been removed.[12]

Microstructure of Cell Wall

The cell wall has been dissected into layers, fibrils, fusiform bodies, and spherical units.

Wood fibers are composed of concentric sleeve-like layers[13, 14] which cling together. This clinging of the layers is partly accounted for by their molecular adhesion and is further augmented by a cementing substance. It is plausible to consider such a cementing material as consisting of ligneous and hemicellulosic materials present in the aqueous protoplasmic solution from which the polysaccharides of the consecutive cellulose layers crystallize. Thus between the cellulose layers of the cell wall there would remain an aqueous protoplasmic film of hemicelluloses or other materials which would eventually solidify to form a binding substance in any interstices between successively developed cellulosic layers.

Similarly, a cementing substance appears to be present in the interstices between fibrils. The Forest Products Laboratory has no experimental evidence that a cementing material is located between the microstructural units smaller than the fibrils; neither has it any evidence to the contrary.

The layers of delignified fibers can be loosened by either alkaline or acid treatments (Fig. 5) and if short fiber sections having open ends are employed the concentric layers can be separated[12] by slipping them from one another, endwise (Fig 6).

Except for the numerous pit apertures, the outer layer before being subjected to dissecting agents, appears as a smooth homogeneous capsule that is slender and pointed. After the chemical dissecting agents are applied, however, transverse striations appear (Fig 7). Continued treatment discloses that the layer is actually composed of fine cellulosic strands,[15] termed fibrils, which are wrapped around the inner concentric layers almost at right angles to the fiber axis (Fig. 8).

As will be discussed later, the outer layer helps to retain the shape of the fiber by restraining swelling beyond certain limits transversely.[16] This function is manifested by the beadlike appearance which fibers develop when treated with acid and alkaline swelling agents that dissolve the outer layer from restricted areas of the fiber (Fig. 9). The areas over which the outer layer is intact appear as constrictions between the swollen beadlike structures.

The inner layers that have been loosened from one another can be distinguished under high magnification (Fig. 10) both in the beadlike structures and in the constrictions, but the outer layer is recognizable only about the constrictions.

It is apparent from the foregoing plates that the outer or primary layer consists of fibrils helically wrapped about

1. Maintained at Madison, Wis., by Forest Service of U. S. Dept. of Agriculture in co-operation with the University of Wisconsin.

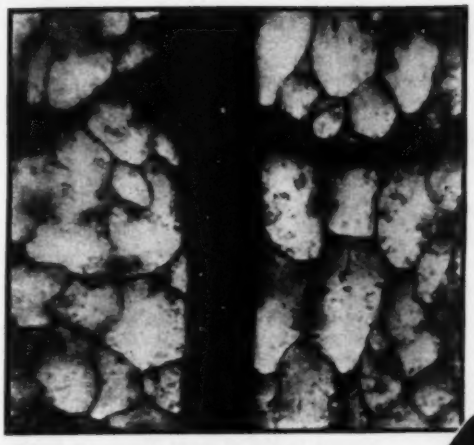


Fig. 1—The middle-lamella lignin and the cell-wall lignin of red alder

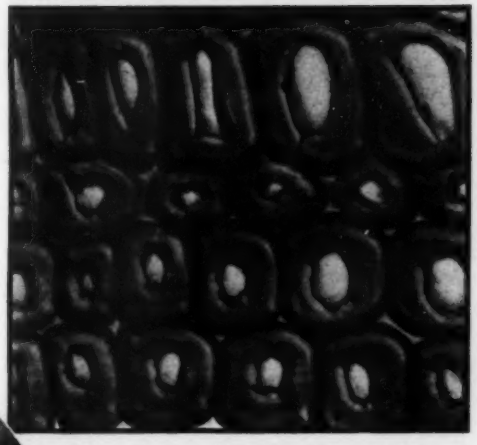


Fig. 3—Cross section of ponderosa pine showing carbohydrates (Cross and Bevan cellulose) partially delignified

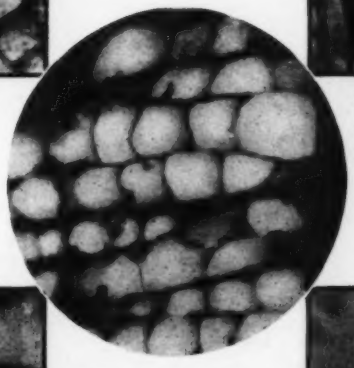


Fig. 2—The middle lamella lignin of ponderosa pine

Fig. 4—Cross section of ponderosa pine showing delignified Cross and Bevan cellulose

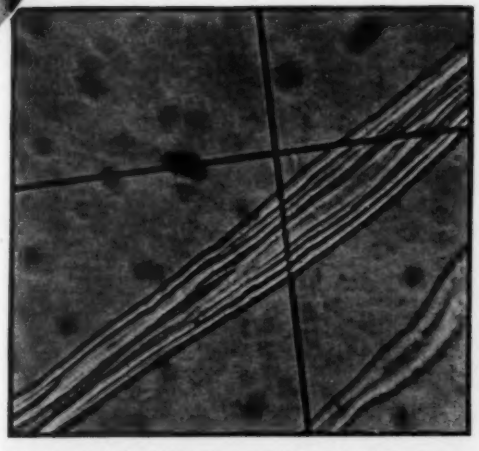


Fig. 5—A delignified elm wood fiber the layers of which have been loosened

the secondary cell wall to form, in conjunction with interfibrillar cementing material, a smooth-surfaced capsule. It is recognized, on the other hand, that a striated appearance resembling fibril windings could also result if the primary layer were a homogeneous envelope as suggested by Trogus.[17] Rupturing of such an envelope by swelling agents would allow the secondary walls to form beadlike structures which would force the primary layer to fold, forming transverse striations (Fig. 11). It is improbable, however, that the uniformity in the transverse striations as shown in Figs. 8 and 9 would obtain under such conditions. It is further inconceivable to procure with such a suggested structure a helical winding as disclosed in (Fig. 12), which shows the fibril windings of the isolated primary layer slightly stretched.

The structural arrangement of the outer layer and that of the inner layers is different. The inner layers are composed of fibrils oriented more nearly parallel (10 deg. to 30 deg.) to the long axis of the wood fiber than those in the outer layer (Fig. 13). The helical arrangement of the fibrils varies in adjoining layers of the cell wall of the same fiber; in normal fibers the variation ranges from 5 deg. to 30 deg., in compression fibers from 30 deg. to 45 deg. The windings are either all clockwise or all counter-clockwise in the same fiber. This finding is contrary to that of Lüdtke[18] who states that the windings alternate from clock to counter-clockwise in adjoining layers of the same fiber. The alternate markings shown in (Fig. 13) are on the opposite walls of the collapsed fiber and not on successive layers in the wall.

Fibrils

As already mentioned, the outer layer of the wall restrains transverse swelling of the wood fibers. In contrast, the several inner layers of the cell wall restrain longitudinal swelling of the wood fibers. These two restraints can be explained on the basis of the cellulose micelle arrangement in the fibrils of the layers. These micelles are oriented parallel with the fibril axis. Swelling them with water increases their longitudinal dimensions very little, but it increases their transverse dimensions 20 per cent.[19] The arrangement of the micelles (transverse to fiber) in the outer layer would, therefore, induce longitudinal swelling but restrain transverse swelling on the wood fiber. In contrast the arrangement of the micelles (parallel with the fiber axis) in the several inner layers would induce transverse swelling but restrain longitudinal swelling of the wood fiber. Since the cellulose micelles of the inner layer fibrils constitute the major portion of the fiber wall, they confine any change in fiber length within exceedingly narrow limits when water is employed as the swelling agent.

Fig. 6—Short sections of delignified elm wood fibers the cell-wall layers of which have been loosened and partially separated by slipping them endwise

◆ ◆

Fig. 7—Transverse striated appearance of wood fiber observed when the fibrils of the outer layer begin to loosen

◆ ◆

Fig. 8—Windings of the fibrils of the outer layer of a wood fiber and the extreme transverse swelling of the inner layers from which the outer layer has been dissolved

◆ ◆

Fig. 9—Transverse swelling of inner layers in places at which outer layer has been dissolved

Wood fibers from which the lignin and the hemicelluloses have been removed can be easily dissected into their fibrils (Fig. 14), provided they are not allowed to dry before the acid or alkaline dissecting agents are applied. Once these structural units of the more stable cellulosic materials shrink together through dehydration, extreme difficulty is experienced in dissecting them from one another. This increased resistance of the cell wall to dissection is likely due to traces of hemicelluloses dispersed into fine particles which form during the alkaline or acid treatment for removing the carbohydrates and which become horny-like substance on subsequent drying. The result is a more resistant cementing substance between the fibrils and also the layers than was present in the original fibers. It is recognized that the increased resistance of dehydrated fibers to dissection may also be explained on another basis. In case no interfibrillar cementing material were present in the chemically treated fibers, dehydration of those fibers would shrink their fibrils together to form between them (fibrils) molecular adhesive forces which would retard the re-entrance of chemical dissecting agents. Fibrils separated from the inner layers are long, slender, cellulosic filaments which appear extremely flexible when suspended in an aqueous medium.

In connection with the length of fibrils, Lüdtke[20] introduces new structural elements. He believes that these elements differ chemically from both the lignin and the carbohydrates and has described them as being composed of a Fremdsubstanz. According to his conception, the fibrils are limited in length by transverse elements intersecting them at fairly uniform intervals corresponding to the constrictions between the beadlike swelling shown in Fig. 9. Definite contrast observed at the Forest Products Laboratory between the optical properties of the outer layer and the remainder of the cell wall indicates the only transverse structural arrangement of the constrictions in the outer layer. This contrast is observed if the fiber constrictions are viewed with the aid of crossed Nicol prisms between which a quartz plate has been inserted. When the windings of the outer layer appear blue, the remainder of the cell wall appears yellow. This indicates that the crystalline elements of the outer layer are at approximately right angles to the corresponding ones in the remainder of the cell wall. Further evidence that the fibrils of the inner layers extend longitudinally through the constrictions without being intersected by transverse elements is furnished in Fig. 10. When the outer layer is removed, the constricted sections separate into longitudinal fibrils.

Still other additional evidence that disproves the presence of transverse walls in wood fibers is furnished by the isolation of fibrils and bundles of fibrils more than 40 to 60 microns in length, the distance between the cross walls as given by Lüdtke. Fibrils and bundles

of fibrils approximately 230 microns long have been isolated from sections of fibers as shown in Fig. 15.

Under certain conditions wood fibers fracture rather abruptly in the crosswise direction. This fact has been used by Lüdtke[20] as an argument for the presence of transverse elements. Abrupt transverse fracturing is especially noticeable in the residue remaining after the fibrous material has been heated in boiling 12 per cent hyrochloric for the conversion of the pentosans to furfural. Similarly, following prolonged alkaline and acid treatments fibers become brash and break abruptly. Such treatments dissolve the cementing substance from between the layers and the fibrils and also swell the residue beyond its green volume, thereby weakening the valence bonds between the cellulose micelles. These modifications, then, weaken the fiber structure both longitudinally and transversely, but the anatomy of the fiber is such as to induce transverse rather than longitudinal fractures. The seemingly abrupt transverse fractures of the cell wall generally occur in the slip planes, in the weak areas of the pits, and in the thin areas which compensate in the wall structure for the bars of Sanio in the middle lamella.

Lüdtke[20] contends that the Fremdsubstanz, which constitutes the transverse elements just discussed, forms an elaborate structure known as a skin system, "Das Hautsystem." This skin system includes the transverse elements, the primary or outer layer of the cell wall, and sheaths around each of the layers of the secondary cell wall, each of the fibrils, and each of any smaller structural units. According to such a concept, the carborhydrate units are each in a compartment whose walls are a part of the skin system.

Lüdtke[20] determines the amount of skin system in the cell wall by first oxidizing fibers to form carboxyl groups which are assumed to develop on the skin substance. These carboxyl groups are then neutralized with a standard solution of alkali. The amount of alkali consumed is a measure of the carbyoxyl groups. Assuming the molecular weight to be 200 and each molecule having one carboxyl group he finds the content of skin substance in the wood fibers to average about 2.8 per cent. This value approximates the polyuronide content of maple Cross and Bevan cellulose as determined at the Forest Products Laboratory.

As has been previously stated, observations at the Forest Products Laboratory indicate that a hemicellulosic cementing material occupies the interstices between the cell wall layers and between the fibrils. Such a cementing substance often appears as flakes when fibrils are torn apart mechanically after they have been partly loosened by chemical means. It is difficult to distinguish optically between the cementing material and the layers or the fibrils of untreated fibers. This may be explained on the basis of very thin films of the cementing material in comparison with the layers and fibrils. It may

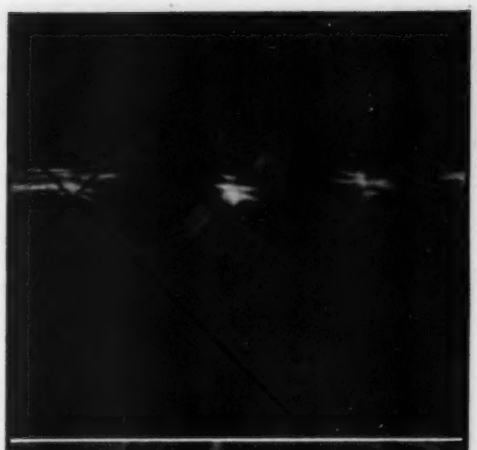


Fig. 10—Continuous longitudinal structure of inner layers of the cell wall can be distinguished in both the swollen and the constricted parts; the outer is recognizable at the sides of the constriction only

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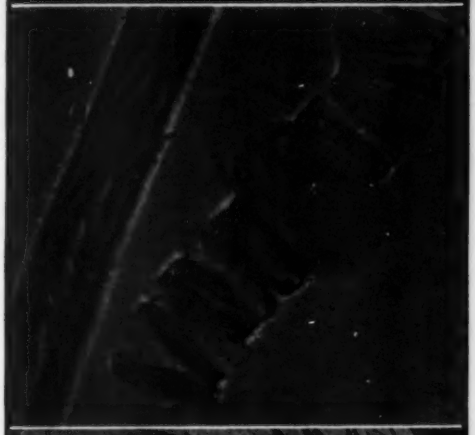

Fig. 11—Windings of the outer layer pushed apart by the extreme swelling of the inner layers

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Fig. 12—Outer layer removed from the delignified spruce fiber and stretched slightly endwise

◆ ◆

Fig. 13—Partially loosened fibrils of the inner layers of a delignified elm fiber

Fig. 14—Isolated fibrils and bundles of fibrils from a delignified elm fiber

Fig. 15—Fibrils isolated from a delignified section of a spruce fiber

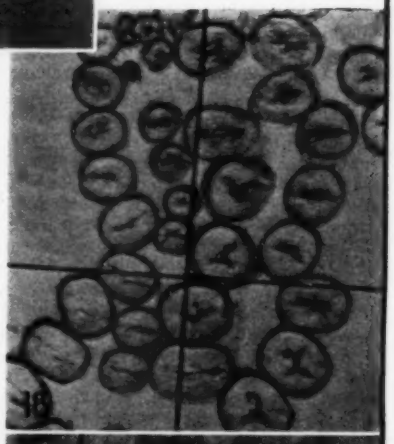

Fig. 16—Fusiform bodies from an elm fiber

Fig. 17—Spherical units isolated from spruce fibers

Fig. 18—Cross sections of delignified spruce fibers after swelling with sodium hydroxide solution

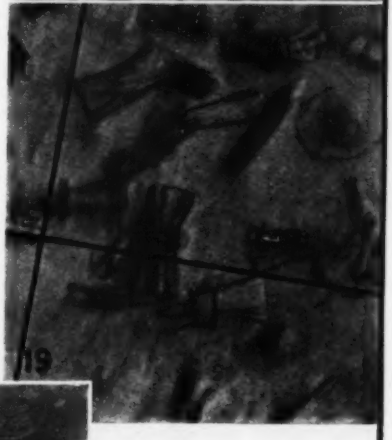

Fig. 19—Short sections of delignified elm fibers showing bundle-like residue when the dissolving action of the phosphoric acid is arrested before the outer layer is completely removed

also be explained on the basis of close agreement between the indices of refraction of the cementing substances and that of the polysaccharides in the layers and the fibrils. After the cementing material is dissolved and the layers or the fibrils are loosened, stratifications and striations become prominent. This change in optical properties occurs because a dissolving medium having an index of refraction different from that of microstructural units has been introduced into the interstices previously occupied by the binding substance.

The foregoing conception concerning hemicellulosic cementing substances accounts for only a small part of the hemicelluloses in delignified wood fibers. The remaining portion is intimately associated with the cellulose in the fibrils, the fusiform bodies, and the spherical units.

Fusiform Bodies

Wood fibrils can be dissected[21] into small, spindle-shaped units, termed fusiform bodies (Fig. 16). These microstructural units of the fibrils may be cemented together similarly to the fibrils and the layers for it requires dissolution of some carbohydrate material before the fusiform bodies can be separated from one another. Wiesner[22] states that fibers after prolonged treatment with hydrochloric acid and subsequent heating from 50 deg. to 60 deg. will carbonize, leaving a fine dustlike residue called dermatosomes. However, the described structure of the particles in that residue is not comparable to the uniformly shaped fusiform bodies.

Spherical Units

Fusiform bodies can be divided by means of phosphoric and sulphuric acids into still smaller, characteristically shaped subdivisions[23] called spherical units (Fig. 17). Since spherical units have not been observed in the fusiform bodies their original structure is unknown, but some shape other than spherical is suggested by a contrast of their optical properties with those of the fusiform bodies.

Between crossed Nicol prisms, fusiform bodies manifest a sharp angle in changing from the minimum luminosity (parallel to Nicols) and the maximum luminosity (45 deg. to Nicols). Such phenomena indicate parallelism of cellulose crystallites in the fusiform bodies. Since the fusiform bodies manifest parallel arrangement in their crystalline structure then their smaller composites must also have parallel crystalline structure, for otherwise the sharp angle in minimum and maximum luminosity would not obtain. Isolated spherical units, however, when viewed between crossed Nicol prisms are luminous in all positions, indicating random arrangement of their crystallites. Such an arrangement of the crystallites would result during the deformation of an angular oblong body to a spherical one by means of extreme swelling.

Some Swelling Properties Due to Fiber Structure

Due to their structure and their property to absorb swelling agents, isolated wood fibers are prone to change their cross-sectional area from an angular to a circular shape.

This tendency of fibers to assume shapes having the least possible external surface when swollen with alkaline solutions manifests itself especially when the outer layer is intact. For example, if short cross sections of delignified fibers are treated with dilute alkaline solutions their angular perimeters become gradually curves (Figs. 3 and 4); if the swelling is increased by means of a stronger alkali, the cross section of the angular tubes becomes one of a circular rod (Fig. 18). When the outer layer is removed fibrillation develops rapidly. Moreover, retention of the outer layer at the middle of short sections produces neatly wrapped bundles having broomed ends (Fig. 19).

Cell Wall Structure as Observed Through a Spierer Lens

Siefriz[24] and Thiesen[25] with the aid of a Spierer lens attached to a microscope, have photographed what they call the cellulose micelles. Their photographs show white parallel striations on a dark background. At short intervals indentations appear to separate the striations into slender rods aligned end to end. In a cross section of wood the white striations appear in the cell wall, paralleling the perimeters of the cell wall and the lumen. In longitudinal wood sections the white lines are arranged parallel with inner and outer edge of vertical parts of the cell wall and parallel with the fibrils in the horizontal parts of the wall.

While the phenomenon just described is more clearly shown by means of the Spierer lens, the same optical effect can also be seen with the aid of a petrographic microscope when the Nicol prisms are crossed at 90 deg. To see it requires an arrangement of the lighting systems so as to increase to the possible maximum the amount of oblique light passing from the specimen into the microscope lens. The phenomenon as observed with a petrographic microscope is considered at the Forest Products Laboratory as an extreme case of diffraction bands.

Thiesen[25] found the white parallel striations to average 0.83 microns in width and he uses that figure as the width of the cellulose micelle. This dimension of the cellulose micelle, however, can not be reconciled with the cellulose micelle conceived from X-ray measurements,[26] which approximates only 50 A.U. in width. Further, the width of the cellulose micelle as conceived from X-ray patterns is far below the resolving power of the microscope.

Summary

The major portion of the lignin is located in the middle lamella; the remaining portion is in the cell wall. Cellulose and hemicellulose form the major part of the cell wall, which is composed of several thin layers arranged as concentric sleeves that can be loosened chemically and separated mechanically by slipping them off from one another endwise.

Layers of the cell wall can be separated into fibrils by chemical and mechanical means. The fibrils of the outer layer are oriented at approximately 90 deg. to the fiber's long axis, whereas those in the remaining layers are oriented anywhere from zero to 30 deg. to the fiber's axis.

Fibrils can be separated into fusiform bodies that are uniformly spindle-shaped.

Fusiform bodies can be separated into smaller subdivisions which are spherical in shape when separated and have accordingly been named spherical units.

A cementing material of hemicellulosic nature is believed to exist between the layers and the fibrils of the cell wall of delignified fibers. When the material is removed by means of hemicellulosic solvents, the layers and the fibrils of the cell wall can be separated by mechanical means. The conception of Lüdtke regarding the Fremdsubstanz, or cementing material in the cell wall, is discussed.

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Individual vs. Group Drainage of Paper Machine Dryers

By H. R. MASTERS, Engineer
The Coe Manufacturing Company

THE trend in the past fifteen years has been very noticeably toward the use of small individual traps for dryers, heaters, cookers, etc., as against the earlier practice of grouping a number of units on one big trap. It is generally recognized by industrial engineers that better performance and production are thus obtained. The individual steam trap for drainage of paper machine dryers in this same period of time has greatly diminished. Why should the trend in paper mills be opposite to that of other industries?

One reason for supplanting the individual trap was maintenance difficulties; another was the impossibility of detecting a defective trap or syphon except by measuring the dryer surface temperature; but by far the greatest and most insurmountable difficulty was air elimination. In draining paper machine dryers, larger air volumes are encountered than in other industries where small individual traps are becoming increasingly popular. Improper air elimination results in slow and irregular drying and large losses in efficiency and heat transfer.

The major item affecting the transfer of heat in the dryers is the presence of air which is evidenced by the accompanying table showing temperature reductions caused by air at various pressures.

Gauge Pressure	*Temperature of Steam Without Air Present*	*Temperature of Steam Mixed with Various Amounts of Air. (Per Cent Air by Volume.)*		
		10 Per Cent	*20 Per Cent*	*30 Per Cent*
10.3	240.1 Fahr.	234.3 Fahr.	228.0 Fahr.	220.9 Fahr.
25.3	267.3	261.0	254.1	246.4
50.3	298.0	291.0	283.5	275.1
75.3	320.3	312.9	304.8	295.9
100.3	338.1	330.3	321.8	312.4

The presence of 30 per cent air by volume in steam is not uncommon, yet because it is not seen, it is hard to realize the extent to which it reduces heating or drying capacity. The temperature drop, considering only 10 per cent air at 10 lb. pressure, is 6 deg. Fahr. Paper while being dried will assume an average temperature of about 190 deg. Fahr., and the temperature head considered effective with no air present is 240 deg.—190 deg. or 50 deg.; with 10 per cent air, it is 234.1 deg.—190 deg. or 44.1, so the loss expressed in percentage is 6/50 or 12 per cent. For 30 per cent air the percentage loss is 40 per cent on the same basis.

Added to the effect of reduced thermal head is the effect of the lowered coefficient of heat transmission from steam to metal or, in other words, the increased resistance to heat flow. While this loss is small compared to the reduction in heat flow due to the decreased head, it is nevertheless appreciable. In the above case based on the heat flow of 2,000 B.t.u. per square foot per hour, the effect would be the same as if the thermal head were decreased an additional one degree, making the net loss in heat flow from the combined effects about 14 per cent for 10 per cent air. For 30 per cent air the loss would be about 44 per cent.

In an attempt to overcome these fundamental difficulties, principally those due to air, various systems have come into use during the past twenty-five years.

Systems Now in Use

The prevailing drainage system consists of grouping dryers in one to four groups connected in series or parallel or a combination of the two. The condensate is removed at a corresponding number of points by means of tanks, traps, pumps, etc. Some of the recirculation or so-called high-velocity systems where steam for the last group must pass through the first group are rather complicated in principle and operation.

These systems undoubtedly overcame some of the mechanical and operating troubles common to the use of a multiplicity of steam traps. Yet they developed other difficulties because, in connecting a number of dryers in parallel, slight differences in piping connections and in rates of condensation cause accumulations of air in some of the dryers so that an even temperature control is hard to maintain. Any trouble with the syphon pipes is not easy to detect and also affects the circulation and results. A decrease in efficiency after some use frequently results in expensive changes in piping and other remodeling in an attempt to overcome these difficulties or to adapt the system to meet changing conditions.

It is argued that this staging of the machine in sections gives better quality of product, due to the small or graduated drops in pressure between sections, but systems with the dryers all in one group give equally good results. Another argument advanced is that an increased steam velocity through the dryers has an important effect on the heat transmission and dryer temperatures. Steam, however, is a gas, and to have any appreciable effect on heat transmission in passing over a surface such as the inside of a dryer shell it must have a minimum velocity of 400 to 500 feet per minute, with an optimum of around 1,500 feet per minute.

An average dryer, on the other hand, condensing 300 lb. of steam per hour, or 5 lb. per minute at 10 lb. pressure would have a steam volume equal to 5x16.5 or 82.5 cu. ft. per minute, and a velocity through it or over its surface equal to $\frac{82.5}{22 \times \pi}$ or 6.6 ft. per minute. Assuming that the dryers are grouped in two sections, this velocity would be increased approximately 50 per cent or to 10.0 ft. per minute. If the machine were divided into three sections, the velocity would be approximately doubled or 13.3 ft. per minute. The chief effect of this staging, therefore, would be to increase the velocity through the syphon pipes rather than to increase heat transmission.

It is obvious from the foregoing paragraphs that neither steam traps nor the group systems are satisfactory to meet all the requirements for perfect drainage which are as follows:

1. A system that will give maximum production and efficiency.
2. A minimum of maintenance and attention.
3. The ability to remove any variable quantity of air that may be encountered regardless of conditions.
4. A positive visual indication of the operation of each individual dryer.
5. A means to adjust drainage conditions of each dryer independently.

A new individual condensation drainage device which appears to fulfill all the above requirements is the Coe Drainator.

Drainator Construction and Operation

The Drainator is shown in cross section in Figure 1. It consists of a cast iron body which is divided into two chambers; the two chambers being joined through an adjustable orifice "O," surrounded by a circular orifice cage. The first part is a receiving or water seal chamber "R" containing an inlet connection to the vessel or dryer being drained and a baffle chamber "B" located immediately ahead of the orifice. Paral-

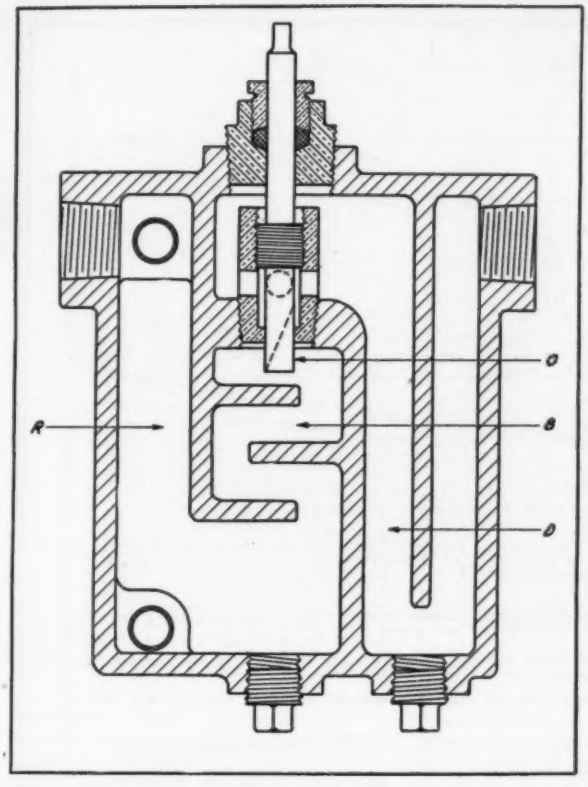


Fig. 1—Cross section diagram of Drainator showing construction

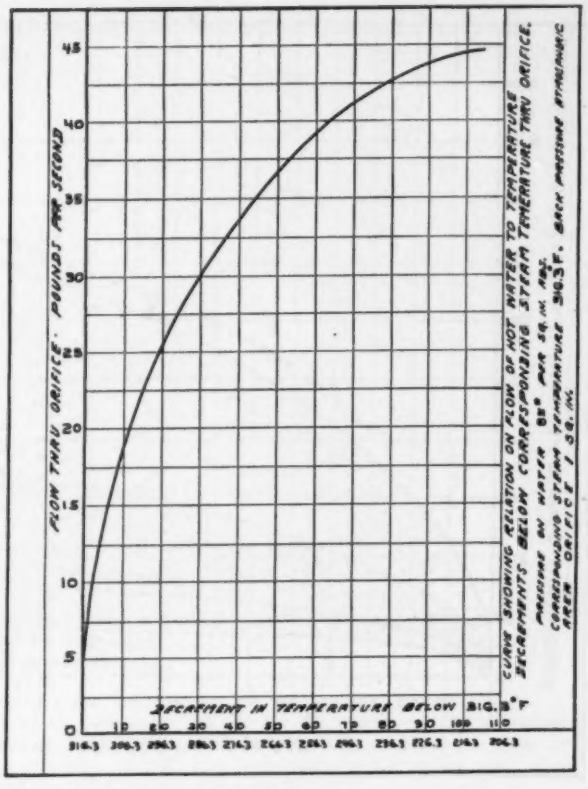


Fig. 2—Temperature decrement curve

leling this chamber is a gauge glass which indicates the water level within it and affords a means of correctly adjusting the orifice to the volume and pressure of condensate being received.

The orifice is a tapered "V" slot cut in a steel stem which can be moved up and down by revolving the stem to give a larger or smaller opening. This movement controls the area of the orfice from zero to full capacity with great accuracy and the stem projects through a packing gland to permit external operation. Beyond the orifice is a re-evaporating chamber "D" with discharge tube connecting to the Drainator outlet. This chamber serves as an equalizer and provides space for re-evaporated steam vapor.

The operation of the Drainator depends upon the functioning of several thermodynamic laws. One of these, and one not generally well known, is based on experiments outlined in *Experimental Researches on the Flow of Steam and Hot Water Through Nozzles and Orifices* by A. Rateau, published by Archibald Constable Co. of London—1905—and now out of print, in which it was shown that the weight of the water discharged through an orifice or nozzle in a given period of time varies inversely with the temperature of the water—the colder the water, the greater the flow. The flow diminishes rapidly with increasing temperature at a given pressure, so that from minimum to maximum it is possible to get a variation of nine to one in quantity of flow or discharge as indicated in Figure 2 in which quantity of flow expressed in pounds per second through an orifice one square inch in area has been plotted against temperature decrements.

By decrement is meant the difference in the temperature of the water at a given point and pressure from the temperature of saturated steam at the same pressure. The temperature of condensate is always below the temperature of the steam so that some decrement must exist. This is obvious because steam cannot condense in a vessel unless the walls of the vessel are at a lower temperature than the steam. If the walls are at the same temperature, there is nothing to cause condensation. It follows that the condensate which is in intimate physical contact with the walls will tend to approach the temperature of the wall rather than the temperature of the steam above it and thus produce temperature decrements.

When passing through an orifice or converging nozzle, due to a difference in existing pressure, some of the hot water must flash into steam again on account of the B.T.U. given off from the drop in pressure and corresponding temperature of the condensate. A given quantity of the water, therefore, must immediately be re-evaporated into steam at every point where a drop in pressure occurs. This results in an expansion in volume from water to steam or vapor.

To demonstrate this point, consider the simple case where hot water with 100 lb. steam pressure back of it is being discharged through a suitable orifice against atmospheric or zero pounds pressure. If the condensate temperature is 338 deg., it must drop to 212 deg., so 126 deg. B.T.U. is given off and approximately 13.0 per cent of the water becomes steam at atmospheric pressure. Each cubic inch of water then becomes 1700 cu. in. of steam, so the resultant volume per cubic inch of water may be calculated as follows:

$$.13 \times 1700 = 221$$
$$.87 \times 1 = .87$$

Volume of mixture steam and water = 221.87 cu. in.

Water being discharged through an orifice will flow at a rate proportional to the square root of the head, unless the temperature of the water is higher than its boiling point in the discharge space causing flashing as outlined above. This flash action takes place in the orifice throat, due to reduction in pressure at that point. The very large expansion causes a reduction in discharge rate, due to the space occupied by the steam leaving less space for the hot water or condensate. The rapid change in flow with small temperature changes near the boiling point is the underlying law made use of by the Drainator.

In practice, the Drainator orifice is first set by means of observing the action of the water in the gauge glass, to a position or area of opening corresponding to the maximum amount of condensate to be handled. This rate will naturally vary, so that at times the condensate is being discharged through

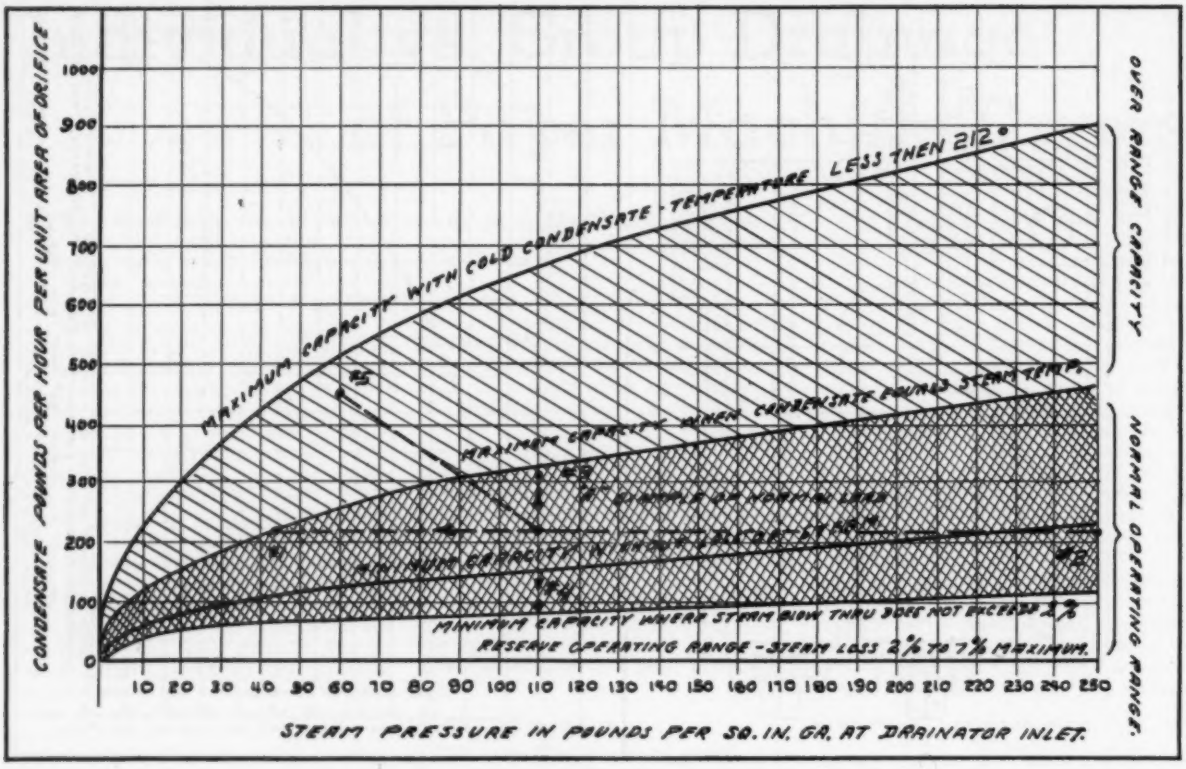

CONDENSATE POUNDS PER HOUR PER UNIT AREA OF ORIFICE
1000
900
800
700
600
500
400
300
200
100
0
MAXIMUM CAPACITY WITH COLD CONDENSATE - TEMPERATURE LESS THEN 212°
MAXIMUM CAPACITY WHEN CONDENSATE POUNDS STEAM TEMP.
#5
#2
#2
MINIMUM CAPACITY WHERE STEAM BLOW THRU DOES NOT EXCEED 2%
RESERVE OPERATING RANGE - STEAM LOSS 2% TO 7% MAXIMUM.
OVER RANGE CAPACITY
NORMAL OPERATING RANGE.
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
STEAM PRESSURE IN POUNDS PER SQ. IN. GA. AT DRAINATOR INLET.

Fig. 3—Characteristic performance chart

the orifice at a rate faster than it is coming into the Drainator, a situation that causes the water seal to be intermittently broken permitting the passage of a small amount of steam and air up through the water contained in the baffle chamber and out through the orifice. The steam, however, in passing up through this water, heats the water very closely to its own temperature, which has the effect of reducing the capacity of the orifice.

The discharge rate then drops down at the orifice to a value lower than the rate at which the condensate is entering the Drainator, causing the condensate to build up in the receiving chamber and to re-establish the water seal. Due to radiation losses, the condensate temperature quickly falls to its original condition and the rate of discharge of hot condensate again increases, causing the water seal to break at a rate of 20 to 30 times per minute. This breaking of the seal develops a pulsating motion, permitting the positive elimination of water, air and non-condensible gases from the system or equipment to which the Drainator is applied without air vents or by-passes.

The quantity of steam used in this manner is so small that it cannot be measured in the normal operating range of the Drainator. It will be noted in Figure 3 that with no condensate at all present, the maximum capacity of the Drainator to discharge steam is about 7 per cent of its capacity to discharge hot water at the same pressure. This is due to steam having many times the volume of water, so naturally the same weight cannot be handled per unit of time in a given orifice. At 25 per cent of capacity for a given orifice setting, the maximum amount of steam blow through in addition will not exceed 2 per cent of its rated capacity in pounds of water. Again, at 50 per cent of capacity, which is a more nearly normal operating condition, the loss of steam along with the air is so small that it cannot be measured in a laboratory using very accurate means of testing. The Drainator principle is new in that the orifice is never actually closed. It is always discharging water, air or steam at varying rates. There is a definite circulation at all times and extremely accurate temperature controls are obtained.

Air Handling Capacity of Drainator

It can now be demonstrated mathematically and by means of the decre-

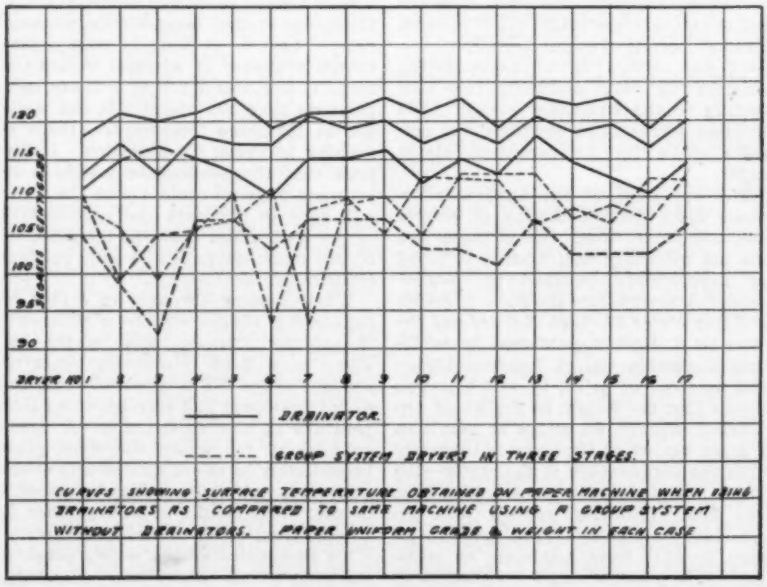

120
115
110
105
100
95
90
DRYER NO. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
DRAINATOR.
GROUP SYSTEM DRYERS IN THREE STAGES.
CURVES SHOWING SURFACE TEMPERATURE OBTAINED ON PAPER MACHINE WHEN USING DRAINATORS AS COMPARED TO SAME MACHINE USING A GROUP SYSTEM WITHOUT DRAINATORS. PAPER UNIFORM GRADE & WEIGHT IN EACH CASE

Fig. 4—Comparative dryer surface temperature curves

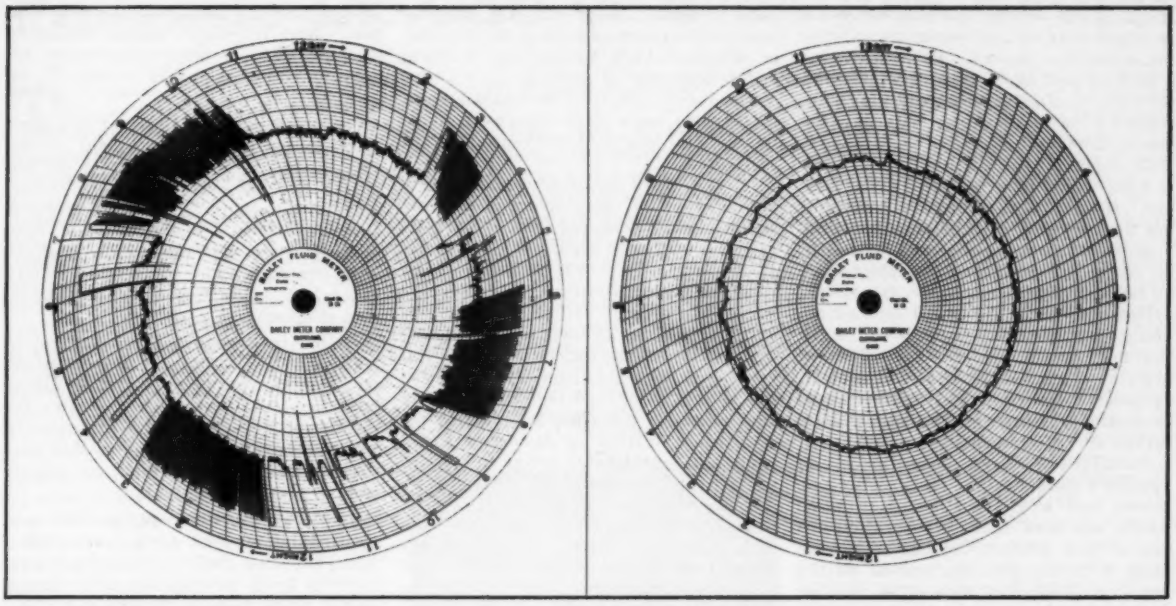


Fig. 5—Condensate removal chart before installing Drainators

Fig. 6—Condensate removal chart after installing Drainators

ment curve that it is impossible to air bind the Drainator, as with the presence of air, the discharge rate of the Drainator automatically increases until the air is eliminated.

Assume, for example, that there is 10 per cent of air by volume in the equipment or system to which the Drainator is being applied, and that the total pressure of steam and air is 100 lb. (90 lb. of steam and 10 lb. of air). According to Dalton's Law of Air and Steam Pressure, the volume of each in the vessel is exactly proportional to the partial pressure of each, and total pressure equals the sum of the partial pressures. However, the temperature of the mixture, instead of being 338 deg., corresponds to the pressure of the steam only, 90 lb., and is therefore 331 deg. Thus the decrement in temperature is increased by 7 deg., due to the presence of 10 per cent of air in the system. If the average decrement of water at the Drainator is taken as 11 deg. Fahr., corresponding to a flow of 20 lb. per second of water per square inch of orifice area, increased decrement of 7 deg. Fahr. will increase this flow to 24.5 lb. or 22½ per cent, corresponding to only 10 per cent of air in the system. This increased rate of flow will continue as long as this percentage of air exists, and, with increased quantities of air, the rate of discharge of the Drainator will increase more than in direct ratio to the percentage of air increase. The air will thus be eventually automatically eliminated, and, as the temperature of the condensate gradually increases to normal, the discharge flow from the Drainator also slows down to its normal rate.

In simple language, the presence of air cools the condensate, and the flow increases until the air is eliminated without using air vents or by-passes. This is the reverse of the performance of all mechanically operated traps, as, with lower condensate temperatures, the heat transmission and condensate volume also diminishes in proportion. As the bucket, pot, or float is dropped, raised, or tilted by a given weight of water, it will then operate at a slower rate corresponding with the decreased volume of condensate, thereby liberating less water and air, which causes an air bound condition.

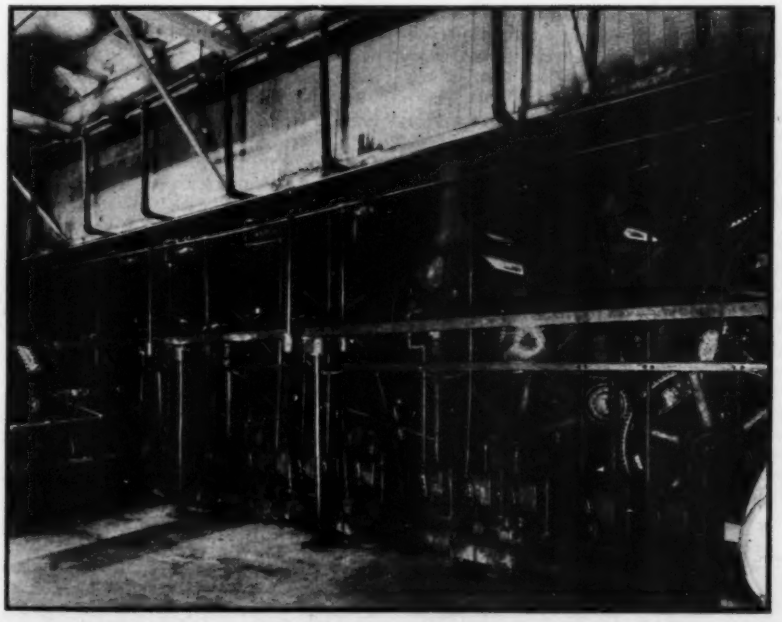


Fig. 7—Installation view of Drainators on a 66-dryer board machine

Some interesting demonstrations of air elimination have been made by Drainators applied to retorts filled with air and steam and with all vents closed. The Drainators first discharged the air, then air with some water and steam until the air was eliminated, when it resumed its normal discharge rate as a condensation drainage device. With continuous elimination of both air and water, the rate and efficiency of heat transfer may be increased so that many Drainator installations on dryers, heaters, coils, kettles, etc., where air is a problem have resulted in temperature increases of 10 to 40 deg. Fahr. when using the same steam pressure.

Drainators operate effectively against wide differentials in pressure, so live

steam in one section and exhaust steam in others may be used when discharging into a common header. There is always a positive seal against the flow of steam through the Drainators, and a good differential is maintained between the steam inlet and return line pressures. This rapidly expels the air and water in each dryer, insuring good fast drainage. If steam and return line pressures are low, a vacuum pump may be of advantage in handling the condensate. If, on the other hand, they are fairly high, as on some board machines, the return system amy be of the closed type with a motor driven turbine pump to return the hot condensate to the boiler or heater. This, with some simple arrangement for control of temperatures or steam pressures on the supply side, fulfills all requirements.

Installations have been made on Yankee dryers, several corrugating machines and a 66-dryer board machine which has now been in operation for almost two years. Comparisons were made with the previous system on the same machine and also with another make of system operated on a similar machine in the same room and on the same product. Both of these systems used for comparison were of the grouped or so-called high velocity, or recirculation type.

The results obtained in operation and on various tests were extremely satisfactory and may be briefly summarized as follows:

1. The board machine referred to is arranged to use both live and exhaust steam, mostly exhaust, at 3 to 20 lb. pressure in all or a part of the dryers. It is extremely simple to operate and requires little attention, as, after the proper Drainator orifice settings are once determined no further adjustments are required. The regulation at the initial steam inlet is all the dryer operator has to look after, and the ease of operation has been described as remarkable.

2. Quick heating up is obtained and there is a considerable saving in amount of broke or waste obtained in the Monday morning starting period.

3. Dryer temperatures are more even and consistently higher when using the same total steam pressure as before. Figure 4 shows comparative temperature and performance of the first 17 dryers at the wet end of this machine with Drainators and also the previous system. With the same steam pressure in each case, the average temperature increase for Drainators is 10 deg. C., or 18 deg. Fahr.

4. Figure 5 is the Bailey Fluidmeter Chart which records the weight of condensate being discharged from all the dryers and indicates the rather intermittent flow obtained from the previous system. Figure 6 shows the same chart after all of the dryers had been equipped with Drainators and indicates the more rapid and constant flow of the condensate obtained.

5. Due to the continuous removal of both air and water, the dryer surface temperatures are also correspondingly more even, which makes it easier for the operators to produce a higher quality of product. It was noticeable that there was less "cockling" on lighter weight papers.

6. The average tonnage was increased approximately 8 to 10 per cent when using the same steam pressure and making the same average grade of board, which would indicate a substantial fuel economy.

◆ Pacific Mills, Limited, Makes Many Improvements

New equipment affecting everything from the wood in process to the completed sheet is being installed in the plant of Pacific Mills, Limited, at Ocean Falls, B. C. Present plans for development in this northern mill provide for three American 10-in. x 30-in. suspended drum barkers to be installed in connection with the wood preparation plant of this company.

The new drums will replace 16 disc barkers and will provide wood for the groundwood, sulphite and sulphate pulp mills. These drums require special heavy-type construction, and their "U" bars will be welded to the supporting rings. All excavating for the new equipment was started in May, and it is planned to have the installations completed by August first.

This company, within the last few months, has completed the rebuilding of several of its paper machines. As the result of this and the other improvements, its paper mill in the next few weeks will be provided with most of the modern equipment available. No. 1 machine, now in process of being rebuilt, has been equipped with new perforated rolls in the headbox, and the new Johnson type trunnion dandy. Further development calls for a Beloit-Dominion suction couch roll of 36-inch diameter and a Beloit-Dominion rubber covered suction press roll.

No. 2 paper machine has been provided with the same equipment as is being applied to No. 1 machine, excepting that the rubber-covered suction press roll was installed on No. 2 over a year ago. No. 1 and No. 2 machines are 204 inches wide and are running on newsprint operating at about 800 feet.

No. 3 paper machine, an all-purpose unit, was recently equipped with perforated rolls, a rebuilt fourdrinier, a Beloit high-speed shake, a Beloit-Dominion suction couch, and a Beloit-Dominion rubber-covered suction press roll. This machine is operated on news, kraft, chipboard and liner board, running all basis weights from the lightest kraft sheets to 31-point chip. A feature of the rebuilt fourdrinier is that it is equipped with micarta covered table rolls. This machine has Poirier weight regulator and a new Beloit double-slice controls the sheet onto the wire.

No. 4 machine, a general utility machine, runing everything from tissues to kraft, has been equiped with a new Beloit 4-ft. creping dryer, used in connection with the manufacture of toilet tissue specialties. It also has a new Poirier weight regulator.

No. 5 machine, a Bentley-Jackson Yankee, was lately equipped with a new type Ross hood and a Beloit-Dominion rubber-covered suction press roll. The hood is the blast nozzle type, being one of the few installations of this kind. It is equipped with 15 ducts, 9-in. diameter each, having 36 1½-in. diameter blast nozzles, and two ducts each of 13-in. diameter with 37 1½-in. blast nozzles. These blast the hot air directly onto the sheet on the dryer. The hood itself is of metal and wood construction.

◆ Ryerson Completes St. Louis Plant Extension

The new addition to the Ryerson plant and equipment, at St. Louis, greatly increases facilities for storing and dispatching steel and allied products for the St. Louis area.

Approximately 40,000 sq. ft. of floor space has been added by extending one of the large spans 165 feet and erecting a new building across the east end of the main warehouses. The greater part of this new space is given over to the warehousing of products requiring special protection from atmospheric changes. A circulating warm air heating system provides the necessary distribution of heat for the proper storing of sheets, tool steels, welding rod, cold finished bars, bands, hoops and other high grade steels. As Ryerson purchases only prime sheets particular attention has always been given to warehousing this product to prevent any possibility of the slightest condensation of atmospheric moisture spoiling the quality and finish of the many special highly finished grades carried in stock. The new heated area for this protection of products, is almost three times larger than the old heated plant space.

On the second floor of the new building are modern daylight offices equipped with an air conditioning and cooling system.

While the greater proportion of this new adidtion is heated, there is also a large span for mild steel bars, etc.; for cutting, shearing, loading and other general steel-service.

Unusual truck loading facilities are provided. Motor trucks back into a recessed pit in the new span, bringing the floor of the truck level with the floor of the building and thus simplifying the shipping of material. One new crane has been placed in operation and another crane and run-way has been extended through the new building.

Stocks are being increased. Many new products and sizes will be added, making immediately available to the St. Louis area the largest and most diversified stocks of steel and allied products.

Other Ryerson plants are located at Chicago, Milwaukee, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

Professor Dr. Carl G. Schwalbe Retires

By LOUIS E. WISE[1]

THE dean of pulp and paper chemists on the Continent, and one of the outstanding authorities in Europe on the industrial chemistry of wood and celulose retired from active service on the first of April, 1934. Dr. Carl G. Schwalbe, after a valiant fight to maintain his failing health, spontaneously requested the authorities to relieve him of his post as Professor of Chemistry, at the Forest School at Eberswalde.

I recall the glorious spring day on which I travelled from Berlin to Eberswalde seven years ago, and how Dr. Schwalbe met me at the station. My dignified, modest host took me directly to the offices and laboratories of the Forstliche Hochschule, and we spent a fine morning discussing the chemistry of wood and of cellulose, and in examining the semi-commercial equipment, which was then utilized largely by advanced students from the Technische Hochschule at Charlottenburg, where in 1922 Dr. Schwalbe had been named honorary professor.

But Dr. Schwalbe did far more for me than that. After a visit to his home in the Donapstrasse, he left with me an impression of genuine hospitality that served to cement our friendship. He also showed me glimpses of that remarkable courage which served him in maintaining his researches (many of them at his own-expense) during the terrible years of inflation that followed the War. However realizing Schwalbe's innate dislike for these encomiums, I shall confine myself to a breif sketch of his past life and of his work.

He was born in 1871, in Hottingen, Canton of Zürich, Switzerland. After studying at the Guericke Oberrealschule at Magdeburg, and the Dorotheenstädtisches Gymnasium at Berlin, he attended the University at Leipzig and later at Strassburg in Alsace. The young chemist had an excellent and thorough schooling. He served the meticulous Professor Wislicenus as lecture-room assistant, and in 1896 entered the employ of the great Badische Anilin-und Soda Fabrik, at Ludwigshafen—at that time the greatest industrial chemical venture of the world. Here, as dyestuff chemist, Schwalbe probably made his first contacts with the scientific aspects of cellulose technology, and this interest undoubtedly moved him to come to Darmstadt, and to enter the Technical School which was devoted to dye and fiber chemistry. Here, in 1904, at the instigation of the German Association of the Pulp and Paper Industry, Schwalbe undertook the difficult task of training chemists for that industry. He proved a highly competent instructor, and in 1907, he was appointed unofficial Professor at the Technische Hochschule at Darmstadt.

After receiving a call from the Forstakademie (later the Forstliche Hochschule) at Eberswalde to become Professor of Chemistry, Schwalbe left Darmstadt, where he had already influenced a number of outstanding chemists and chemical engineers entering the paper industry. Among these may be mentioned Dr. Bjarne Johnsen of the Hammermill Paper Company. Schwalbe's researches had already shown a rare combination of creative imagination, technical knowledge, and sound commonsense.

In the years that followed Schwalbe's advent to Eberswalde the physical development of his Institute was greatly

Dr. Carl G. Schwalbe

handicapped by the events of the War and post-war periods. It was only in 1930, that the Wood Research Institute with its four branches (Dry-kilning, Preservation, Distillation, and Pulpmaking) became a reality. Meanwhile, however, he had kept a prodigious number of problems in progress, and had as his principal co-workers students from Charlottenburg.

In retrospect, it is difficult to give even a balanced outline of the important pulp and papermaking researches inaugurated by Schwalbe. All chemists connected with the paper industry have had recourse to his publications—dating back over thirty years. The fact which requires emphasis is the pioneering nature of these investigations, and the fearless spirit and the resourcefullness with which they were untertaken. When Schwalbe took the helm, the tools for scientifically investigating wood pulp were conspicuously lacking. He created many of them. Often he gave us a technique for evaluating pulp. The determination of water, by the distillation of pulp with higher-boiling immiscible solvents, the chemical differentiation of soda and sulphite pulps, sedimentation volumes, the degree of swelling in pulp, the degree of beating, the famous copper, cellulose, and hydrolysis numbers, and the baryta resistance of cellulose all emanated from his laboratory. Numerous other investigations merit more than a fleeting mention. Studies on wood-gum, comprehensive researches on the ageing and drying of wood, fundamental work (with his student Becker) on the mechanism of the sulphite process, all deserve serious attention. Then too the methodical researches on bleaching and on the purification of cellulose are of marked importance. Some years ago, when the Cellulose Division of the American Chemical Society undertook a study leading to the preparation of standard, highly purified cellulose, Dr. Johnsen pointed out that Dr. Schwalbe and his co-workers Bay and Robinoff had already laid the groundwork.

The problem of waste sulphite liquor utilization fascinated Schwalbe. Finally he decided that from an industrial viewpoint, its use depended on the fuel value of its components. His wet carbonization of the liquor resulted from that decision.

To round out the picture we should point to Schwalbe's work on the elimination of noxious gases in sulphate pulp production, his extensive studies on the pulping of woods and tropical plants, and to his many ingenious patent applications which stimulated the entire industry so powerfully.

His classical work *Die Chemie der Cellulose* has been out of print for over twenty years, and the second edition is still in the course of revision. It was an exceedingly well planned work, based on experimental data, not a little of which came from the laboratory of the author himself. Another famous work on chemical control, written in collaboration with Dr.-Ing. Rudolf Sieber is the *Chemische Betriebscontrolle in der Zellstoff und Papier-industrie.* During 1908-1922, Schwalbe published regularly his Abstracts (*Auszüge*) of the Pulp and Paper making literature—an enormous help to chemists working in this field.

During this same period, Schwalbe also found time to act as business manager of the German Association of Pulp and Paper Chemists of which he later became the president, and which in 1929 elected him an honorary member. Similarly he held an honorary membership in the Swedish Association of Pulp and Paper Engineers.

We have not attempted the impossible task of listing all of Schwalbe's accomplishments. And in closing we can do no better than to re-echo the sentiment already expressed in the European press that this prolific investigator will, in the due course of time, continue his important work. For chemists of every country realize that Schwalbe has been, and still is a key man in the Pulp and Paper Industry of the World.

[1]Professor of Chemistry at Rollins College, and Professor Emeritus, New York State College of Forestry.

◆ Traveling Grate Stoker

To adapt the Coxe Stoker to wider furnaces, hence larger capacities in the burning of small sized anthracite, coke breeze, lignite and certain non-caking bituminous coals, under forced draft, Combustion Engineering Company has brought out what is designated as the CD Design. This design employs two or more carrier bars placed end to end instead of a single bar across the stoker as in the older design where the length of the bar was necessarily limited in order to avoid warping. These bars carry cast-iron keys the overlapping construction of which prevents ash being carried back to the front of the stoker.

The stoker body is built up of structural steel cross members which, in turn, support the skids and grate surface. As in the smaller design the stoker is driven from the rear shaft with the take-up for the driving chains located at the front.

The new design applies to furnace widths of 12 to 24 ft. whereas the older type, with the single-bar design was limited to 11 ft. 8-⅝ in.

◆ Portable Electric Cleaner

SKILSAW, Inc., 3310-20 Elston Ave., Chicago, has announced a complete new line of portable electric blowers and suction cleaners combined with which is a separate unit for blowing hot and cold air and for blow torch.

The manufacturer states that these tools serve a very definite need in industry wherever a blast of dry air at high velocity yet low pressure is required to clean machinery by blowing or suction. It is also claimed that size for size and type for type, these tools develop more power with a greater degree of safety than has heretofore been expected in portable electric blowers.

Detailed information will be furnished by the manufacturer upon request.

◆ Electric Flow Meter Body

The Brown Instrument Company, of Philadelphia, announces a new meter body for electric flow meters. It is designed for measuring the flow of any liquid, vapor or gas creating a differential pressure across an orifice of 1.6 to 16 inches of mercury.

A seamless steel "U" tube with union compression fittings connects the high and low pressure chambers. A mercury drain mounted on this tube has a hardened needle point screw which seals the mercury drain hole in the "U" tube. Two highly resilient seals of an oil resisting material, seat firmly in the high pressure chamber, one seal on top the float, one underneath.

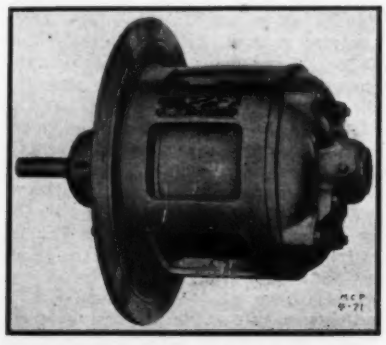
As the mercury level raises and falls with flow changes, the float in the high pressure chamber is free to move and follows the mercury level. Movement of the float is transmitted electrically to the indicating or recording meter by the inductance bridge principle (a patented feature of Brown electric flow meters.)

It is claimed that the entire meter body can be taken apart, cleaned and re-assembled in less than an hour, without removing the piping, disturbing the setting or re-calibrating the meter. Nine interchangeable range tubes with corresponding charts for the recording meter are available. Each range tube is furnished with the right length of pipe range tube support and gaskets all assembled as one unit. A 12-in. wrench to open four unions is the only tool required; remove the old range tube, slip in the new one, connect unions, and the meter body is again ready for operation.

An external pulsation check is designed for precision adjustments with the meter body under full line pressure (2500 lb. per sq. in.). The pulsation check and mercury drain are one unit. The mercury drain may be opened and closed, carrying the pulsation check with it but not changing the setting.

◆ Flanged Head Motors

The Louis Allis Co., Milwaukee, Wis., announces the development of several types of flanged head mountings for their line of electric motors. The flange illustrated is an integral part of the motor head and may be finished on either or both sides. Limitations in space for motor mountings on many applications make it desirable to eliminate motor feet and provide finished flange on motor head for end mounting.



◆ Liquid Chemical Proportioning Unit

D. W. Haering & Company, Inc., 3408 Monroe Street, Chicago, have announced the development and introduction of an automatic proportioning machine designated as the H-O-H Proportioning Unit.

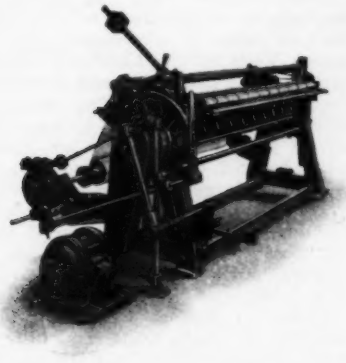
It is claimed that this machine will automatically feed chemicals into pipe

lines under varying conditions of pressure and in any amounts desired. The only manual attention said to be required is the recharging of the unit which may be accomplished in less than five minutes.

In making an installation, it is only necessary to drill and tap two ⅜-inch openings in the pipe line to which it is being attached in order to install pitot tubes. Once the tubes are installed, the machine may be disconnected and changes made in the piping arrangement without interfering with the main flow of liquid.

◆ Slitting Machine

A slitting machine especially designed for high speed production of head rest rolls, shelf rolls and lunch rolls is being manufactured by the Cameron Machine Company, Brooklyn, New York. This machine has produced as many as 10,000 head rest rolls in an 8-hour day and an average production of 50 gross per day is claimed not difficult to maintain.



The rolls are clean cut and uniformly wound from center to outer circumference; and an automatic stop mechanism provides for uniform length of paper in each of them. At the end of a run, the operator presses a foot lever to raise a riding roller which permits the quick removal of the finished rolls. The machine, designated as Camachine 40-1AF, is built in standard widths of 26, 32, 42, 50, 56 and 62 inches. It will accommodate a mill roll 32 inches in diameter and will rewind rolls to a maximum diameter of 10 inches. The standard cutters may be spaced to cut widths from ½ inch up. Special narrow slitters may be spaced to cut widths down to ¼ inch. A 5 hp. motor is ample to take care of a web as wide as 62 inches.

◆ Supervisory Control Mechanism

To meet the demand for an inexpensive means for remote operation of various small stations, the Westinghouse Electric and Manufacturing Company annouce Polaricode, Junior, a small size supervisory control particularly suitable for industrial plants. The new unit includes a raise-lower control combined with simultaneous telemetering indication of position for distant control of variable position apparatus such as valves, rheostats, tap changers, and similar equipment.

Except for size, the unit is comparable to all Westinghouse supervisory control systems. It operates a maximum of five apparatus units. Only two telephone-type line wires are required between the dispatching point and the remotely controlled station. The dispatching cabinet is but 14 in. wide, 21 in. deep and 20 in. high.

The system performs all the various functions of apparatus control, gives continuous and individual signal lamp supervision, telemetering and synchronizing.

◆ Stainless Steel Roller Chain

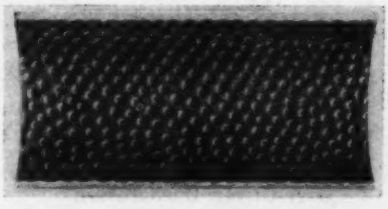
For several years the Diamond Chain & Mfg. Co., Indianapolis, Ind., has been making roller chains of stainless steel on special order. These chains, made

of 18-8 stainless steel throughout, will now be stocked in the most commonly used sizes. They are recommended by the manufacturer for use wherever corrosion is a problem.

◆ Electrical Conduit Development

A new type of conduit that greatly reduces wire pulling friction, is the latest development of the Electrical Division of Steel and Tubes, Inc., Cleveland, Ohio.

The inside of this new conduit, which is called Electrunite Steeltubes, is processed, prior to forming and welding, so that the entire surface is covered with small, round, raised knobs which produce what the manufacturer refers to as

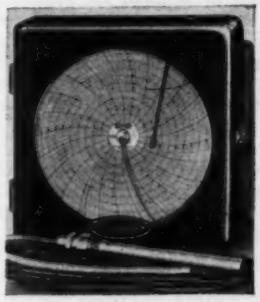


a ball bearing surface. It is claimed by the manufacturer that this type of contact surface reduces the surface friction 30 per cent, and in addition requires less time and cuts down jamming in the pulling of cables.

No threading is required in the installation of this conduit, and it will cut and bend more easily than the old style conduit.

◆ Recording Thermometer

A new recording thermometer has just been announced by the Mason-Neilan Regulator Company, Boston, Mass. This thermometer, equipped with a floating coil clamp, which is said to increase the accuracy of the instrument by eliminating friction and lost motion, may also be equipped with a safety feature to protect the thermal element if temperatures exceed the instrument range. It is claimed that with this new protector excess temperatures of 500 deg. Fahr. over the maximum chart range will cause no damage.



Recorders with multiple pens for recording several different temperatures can be furnished if desired. All parts are standardized and are interchangeable with other Mason-Neilan temperature control instruments.

◆ Master Control for Pressure Regulation

A master control developed primarily for the paper industry where accurate pressure control is essential and where frequent adjustments are necessary to provide the correct pressure for the various grades of paper manufactured has been announced by the Swartwout Company of Cleveland, Ohio.

This control, designated as the Type CPQM Master Control, utilizes the principles of Swartwout S-C Master regulators which have been used in power plants for years together with some new features and refinements. The equipment consists of the pressure regulator to which is attached a small indicating dial and two main pressure gauges, all enclosed in a tamper-proof case. A removable crank is used in adjusting the pressure. A turn of this crank sets the hand on the small dial to the desired pressure which is automatically set up and accurately maintained.

◆ Gun for Graphite Lubrication

A lubricating device being marketed under the name of Graph-Air Gun has been announced by the Joseph Dixon Crucible Co. of Jersey City, N. J. It is made of rubber, and when squeezed deposits where needed the graphite with which it is filled in measured amounts through controlled air pressure. The measured or graphite volume discharged from the gun is largely controlled by the position of the gun's nozzle in relation to a dial on its top. The nozzle may be turned to a complete shut-off position making it practical to carry the gun in a tool kit without spilling graphite.

◆ Personal Safety in the Boiler Plant

When planning provisions to prevent personal injuries and shutdowns in boiler plants, the first thought is to prevent boiler explosions.

Overpressure and low water are the most common causes of boiler explosions. Overpressure in normal operation is likely to occur with a sudden decrease in demand for steam. To relieve the boiler of strains due to overpressure, safety valves are employed. Power boilers should never have less than two on each boiler. Their combined capacity should be sufficient to discharge all the steam that it is possible for the boiler to generate.

Low water results in excessively high temperature of the heating surface above the water level, which not only weakens the tensile strength of the metal, but should water come in contact with it in this heated condition, it is almost certain to crack, due to sudden temperature strains.

Water columns with gage cocks and gage glasses are the essential boiler mountings for determining the water level in the boiler. In addition, however, fusible plugs placed at the minimum allowable water level give warning by melting and allowing the escape of steam that the water level has gone beyond the lower limit and the fire must be drawn.

Leaking blowoff valves or connections are frequently a source of danger and should be guarded against.

The other points on return tubular boilers that give considerable trouble and are sources of danger are the joints between the tube ends and the tube sheets, and the girth seams. What are known as boiler tube thimbles are sometimes used to reinforce the ends of old tubes which have become burned or damaged by rolling. The thimble is driven into the end of the tube so that the flange covers the bead and rolled tightly in place.

Protectors for girth seams of return tubular boilers made of refractory material are sometimes attached to the rivet heads directly over the fire. The seam is thus shielded from the intense heat which is not readily transmitted through the seam.

When a boiler plate bags and lets go without an explosion or a tube blows out, attendants are subject to two dangers. One is the blowing of live coals out of the furnace door into the boiler room. This is guarded against in some plants by the use of fire doors that swing inward, or safety latches on the doors. Both of these provisions are of advantage also in case of a furnace gas explosion.

Probably the more serious danger accompanying a tube blowout is the discharge of steam from the other boilers of the battery back through this boiler and out into the furnace and boiler room. This is guarded against by the provision of a nonreturn valve in the boiler lead which is virtually a steam check valve permitting steam to flow in only one direction through the pipe.

Excess pressure, in piping, tanks, heaters, economizers or other equipment containing water under pressure is guarded against by the use of relief valves set to discharge when pressure reaches the maximum desirable.

Extreme care in the design and installation of the steam piping in boiler plants must be taken if accidents are to be avoided. Proper provision must be made to guard against undue strains in all sections of the piping system by the judicious use of expansion bends, joints and pipe anchors.

Water in steam piping is a prolific cause of boiler room accidents due principally to water hammer breaking pipe fitting and valves. For this reason, piping should be so graded that condensate will flow in the same direction as the steam and no pockets which are not provided with drains should exist.

To remove the danger of water hammer, the steam piping should be well drained by means of drip piping connected at each low point and upward bend in the piping, and also at valves. Safety demands the installation of steam separators in cases where moisture-laden steam is likely to be used in pumps, engines or turbines.

Condensate should not be allowed to remain in the piping and should be automatically removed by means of traps or the steam look system. For the sake of economy, these high pressure drips should be returned to the feed water heater while hot, thus saving not only the heat but the pure water of condensation as well.

◆ LINK-BELT Company announces that to improve its service to the local trade, a warehouse has recently been opened at 413-15 Second Avenue, Dallas, Texas, where extensive stocks will be carried of Caldwell and Link-Belt conveying and power transmitting machinery. The company's sales office will also be located at the warehouse. E. G. Wendell is resident manager.

◆ DR. JAMES BRYANT CONANT, president of Harvard University, has been awarded the medal of the American Institute of Chemists which is presented annually for outstanding service to chemistry in America. The award is made in recognition of Dr. Conant's many contributions to chemical science.

◆ Dorr-Oliver Corporation Dissolved

After affiliation for three years, it has been agreed to dissolve the Dorr-Oliver Corporation, and that The Dorr Company, Inc., and Oliver United Filters Inc. thereafter will operate independently of each other.

Oliver United will, however, undertake the further adaptation and marketing of the Dorrco Filter in the United States and in certain other countries; and Oliver United Products, including filters, will be handled in European territories by the foreign representatives of the Dorr Company.

Both Dorr and Oliver United will continue to be represented in South Africa by E. L. Bateman, Pty. Ltd., Johannesburg; in Australia by Crossle & Duff, Pty. Ltd., Melbourne; and in Japan by Andrews & George Co., Inc., Tokyo, acting independently for each company.

The separation of the two companies has been brought about on an entirely friendly basis, and the many personal friendships which have been formed among members of the two organizations during the past three years will be continued.

◆ F. E. CATON, who has been general superintendent for the Androscoggin Pulp Company of South Windham, Me., for the past two and a half years, resigned that connection on June 1, Mr. Caton will take a month's vacation and will announce his plans for the future a little later.

◆ Institute Grants Degrees to Five Graduates

Commencement day at Lawrence marked the termination of four and one-half years of educational and research work by the Lawrence College Institute of Paper Chemistry, and with the granting of Doctor of Philosophy degrees to five students it becomes the second year that Lawrence has offered this advanced degree. Those who received the degrees are: Richard C. Crain, Frankfort, Indiana; Martin L. Downs, Reading, Pennsylvania; Walter F. Holzer, North Portland, Oregon; Henry E. Obermanns, Erie, Pennsylvania; and Sam J. Robinson, Des Moines, Iowa.

Master of Science degrees were awarded to: Earle O. Bryant, Clinton, North Carolina; Ward D. Harrison, Mason City, Iowa; James W. McIntyre, Freeport, Pennsylvania; Charles E. Roth, Dayton, Ohio; Robert D. Rusch, Neenah, Wisconsin; Harold C. Sperka, Oshkosh, Wisconsin; John C. Tongren, Ridgway, Pennsylvania; LaVern A. Gilbertson, LaCrosse, Wisconsin.

The degrees were conferred at the eighty-fourth annual commencement exercises at Lawrence on Monday, June 11th, by Dr. Henry M. Wriston, president of the college and director of the Institute. The candidates were presented by Dr. Henry F. Lewis, dean of the Institute, and they were invested with their hoods by Dr. Otto Kress, technical director.

◆ New Process for Treating Felts

The following interesting item is taken from "P's & Q's," published by the Philadelphia Quartz Company:

"The problem of felt costs is one which paper manufacturers must always keep in mind. Replacement expense is a serious factor in operating costs and anything which can reduce this item is worthy of consideration. Our attention is called to a patented process which is claimed to render felts resistant to heat, acids and rot by treating the finished felt with a solution of

sodium silicate followed by a bath of magnesium chloride. A protective coating of a magnesium silicate would thus be precipitated on the fibers. Of course, such a process would require careful control to prevent the fibers from being matted and seriously affecting the porosity."

◆ Southern Chemical Corporation Formed

American Cyanamid Company and Pittsburgh Plate Glass Co. jointly have formed the Southern Chemical Corporation, with a Delaware charter, and have qualified to do business in Texas. The new corporation will produce a varied line of chemicals in connection with the operation of the alkali plant being constructed at Corpus Christi, Tex., by Southern Alkali Corporation, also jointly owned by the two above mentioned companies.

It is expected that the plant at Corpus Christi, which has been under construction for something over a year, will be in operation this fall.

◆ Foster Wheeler Acquires Ruths Steam Storage

The Foster Wheeler Corporation has taken over exclusive rights for the sale and manufacture of the Ruths Steam Storage Systems in the United States and Canada. Ruths Accumulators will compliment the present extensive line of Foster Wheeler power plant equipment. Mr. G. M. Cameron, formerly manager of Ruths Steam Storage Company, will be manager of the Ruths Accumulator Division of Foster Wheeler.

Ruths Steam Storage System is a means of storing up steam during periods of light demand for use in periods of heavy demand thereby equalizing the boiler load. This permits higher boiler efficiencies and larger daily boiler output per unit of installed boiler capacity. This system is applicable to many industrial plants and has a special field in certain industries such as pulp and paper mills, and other industries where large amounts of low pressure steam are used for process work.

◆ Colby Made Sales Manager of Combustion Engineering

The appointment of H. S. Colby as general sales manager of Combustion Engineering Company has just been announced by R. M. Gates, vice president of that company.

Mr. Colby, until recently was president of the Air Preheater Corporation. His technical education was acquired at Cooper Union and Columbia University and for the past twenty years he has been engaged in the design, production and sales of steam generating equipment involving boilers, stokers, pulverizers, economizers and air preheaters. This background of experience and an extensive acquaintance in the field of steam generation, eminently fit him for his new duties, which include direct charge of district office activities.

◆ New Catalogues and Publications

American Sheet and Tin Plate Co., Pittsburgh—All over the country the interest of the public has been directed to the record-breaking performance of the "Zephyr," the Burlington railroad's high-speed train, the first Diesel-propelled train of stainless-steel construction, manufactured by the Edward G. Budd Mfg. Co., Philadelphia. A most attractive booklet has been issued by American Sheet and Tin Plate Co., Pittsburgh, in which is published reprint of an article from *Railway Age*. In this article a description of the construction of the "Zephyr" is given, together with a list of companies that supplied material for it. Stainless steel materials used for important parts of construction were supplied by American Sheet and Tin Plate.

Bailey Meter Company, Cleveland, Ohio—A new bulletin entitled "Savings Effected by Bailey Boiler Meters" include actual operating data showing the nature and amount of savings effected in over 20 typical installations of Bailey Boiler Meters which cover a wide range of fuels, methods of firing, types and sizes of boilers. The bulletin contains handy indexes of the type, size, method of firing of boilers and method by which savings are effected. Under each subject is listed the page numbers on which examples may be found. There are meter charts, letters from users and installation photographs all pertaining to the installations on which economies are being effected, also a tabulation of plant data listing major equipment and a summary of savings, also net annual saving and net annual return on the investment for each of the various examples cited.

C. O. Bartlett & Snow Co., Cleveland, Ohio—This company has just published a bulletin containing a complete description of the most popular types of Bartlett-Snow Belt Idlers, together with tables of dimensions, prices, etc., and engineering data relative to their proper spacing, capacities, angles of incline, etc. The company will gladly send a copy of this booklet entitled "Belt Conveyor Idlers" to any interested inquirers.

Deming Co., Salem, Ohio—"New from Start to Finish" is the title of a new catalogue put out by this company. This catalogue gives general information with descriptions, engineering information, tables and other technical data concerning this company's line. Among many new products and developments featured in this publication are the new Marvelette water system, Marvel shallow well pumps and water systems, Oil-Rite shallow well and deep well pumps and water systems, new Worm Drive deep well pumps and water systems and many improvements in other lines. Copies on request.

Falk Corporation, Milwaukee, Wis.—Bulletin No. 271 is devoted to this company's new product, the Falk Vertical Motoreducer, which has just been released after two years of research and testing. These vertical motoreducers are made in three types, which are briefly outlined in the folder and the features of design explained.

General Refractories Co., Philadelphia—A new bulletin is devoted to Carbex Silicon Brick, which is described by the manufacturer as a super-refractory of the finest silicon-carbide type made into bricks or shapes of exceptional smoothness and capable of the greatest possible resistance to internal and surface disintegration and to other destructive influences of high furnace heat and hard physical punishment. The various uses and typical installations of this product are set forth and illustrated in the bulletin.

Flexible Steel Lacing Co., 4607 Lexington St., Chicago—An illustrated booklet entitled "Short Cuts to Power Transmission" has just been published by this company. This booklet supersedes a former edition and is said to contain information needed in solving ordinary belt transmission problems and to be a discussion of belting of all types. There is a great deal of useful information, tables, data, etc. Although written in simple, non-technical style, it is suitable to be included in the library of the engineer. Copies on request.

Lincoln Electric Co., Cleveland, O.—A new folder contains a concise description of this company's new "Linc-Weld" self-protecting motor, which it is claimed, cannot burn out. Dimensional data and illustrations are shown.

Link-Belt Co., 2410 W. 18th St., Chicago—"Firing Method Modernized for Profit" is a new book just published by this company. It gives a comparison of hand firing and controlled automatic underfeed firing of boilers from 10 to 250 b.hp., and illustrates in graphic and pictorial form such features as smoke elimination, uniform temperatures and pressures, coal savings, firing efficiency, etc. Copies upon request.

Norton Company, Worcester, Mass.—This well known manufacturer of Norton pulpstones has prepared an unusual type of booklet in which many questions concerning their product are briefly answered. The booklet is titled "Your Questions Answered" and the cover is decorated with a facsimile of a pulpstone done in Crystolon, the abrasive which is used in the manufacture of Norton pulpstones.

Poole Foundry & Machine Co., Baltimore Md.—The improved one-piece sleeve construction now used in the Poole Flexible Couplings is set forth in a new circular which is available to those interested in this information.

Worthington Pump and Machinery Corp., Harrison, N. J.—Recent new literature received from this company includes: A folder on the Worthington Surface Condensers, patented folded tube layer type, and Worthington Internal Bearing Double Helical Rotary Pumps.

BOOKS

Das Bleichen von Zellstuff (Bleaching of Pulp). This volume, with 141 pages, 31 illustrations, and 10 very useful tables, fills a gap in the German literature, which up to the present, has no individual monograph on bleaching. The first half of the book is taken up with chlorine and the manufacture of bleach liquors. The latter portion deals with equipment used in bleaching, and problems connected with bleaching. The book is written for the practical manufacturer, and has been kept free from purely scientific discussions. Despite this, it should prove of value to chemists, engineers and students, since it has an excellent bibliography (of 139 references) of the recent literature. The author has very wisely abstained from giving detailed methods for determining the degree of bleaching. Here he refers to the classical monograph by Schwalbe and Sieber, and thus avoids fruitless repetition. Among the topics that are thoroughly discussed are: poaching engines (of various types), the chemical processes taking place during the bleaching; the use of chlorine gas, chlorine water, etc.; methods used in hastening the bleaching process, alkaline, neutral and acid bleach; interesting differences between the action of calcium-versus sodium hypochlorite; various types of modern bleaching methods (with a good deal of emphasis placed on the Thorne processes); questions regarding washing of bleached pulp, and the handling of pulp that is to be used in rayon manufacture. This is far from a complete list and it necessarily says nothing about the first and very important half of the book. However, it will give the reader some idea of this useful monograph, written by Dr.-Ing. Eberhardt Munds, and published by Güntter-Staib Verlag, Biberach-Riss. Its price is 4.40 R.M.

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By W. S. JOULE

◆ Brushes and Motor Speed

It was stated in the April, 1934, issue on this page that a slight adjustment of speed in a shunt or compound wound motor might be accomplished by shifting the brushes; that movement in the direction against rotation caused an increase of speed, and vice versa; and that too great a movement of the brushes might interfere with good commutation.

Considerable trouble, in the opinion of L. E. Miller, Direct Current Engineer, The Reliance Electric & Engineering Company, might be caused by such practice at the hand of any except the most experienced; and to this end he has presented the following information to prevent any malpractice:

"When brushes are shifted they quite frequently become slightly cocked and although this cocking may not be greater than a thousandth of an inch the amount of brush face contacting the commutator is changed. The result is that instead of having the total face of the brush, seat properly on the commutator, only a small portion of the face may be seating. This often gives the appearance of satisfactory commutation with such sparking as is actually present being hidden under the brush. As the machine runs, wearing in the new brush face sparking becomes evident but by that time the machine is no longer under close observation and this sparking may be unnoticed until it is found that a burned and blackened commutator has been obtained.

"In addition to commutation troubles which may ensue from shifting the brushes there is also the possibility of trouble from heating. The coolest operation will be obtained when the brushes are in the correct electrical neutral position.

"Still another trouble may be encountered on a shunt wound machine where the brushes are shifted against rotation to increase the speed. The effect of such a shift is to increase the full load speed much more than the no load speed and the resulting decrease in regulation may result in instability. Again this may not be noticeable until the brush seat wears in.

"It is true that the wearing in of the brush seat may be hastened by the application of sand paper or a commutator stone to the commutator and while this is to be recommended if brushes *must* be shifted still even this does not give the perfect contact face which comes from ordinary operation.

"Considering the proposition as a whole; the brushes are carefully located in the correct position by the manufacturer and should not be changed from this correct setting as a method of changing speed as long as any other means is available and that if done it should only be done under the supervision of an experienced representative of the manufacturer."

◆ Do Not Re-Melt Babbitt Too Often

Babbitt metal should not be used over and over again for the reason that every time babbitt metal is melted some of the tin and antimony is burned out. The scum that appears on the top of the metal when it is heated is an oxide formed by the combination of the metal with oxygen from the air.

◆ Condenser Tube Packing Materials

Various materials are used for packing, among which may be enumerated corset lacing or cotton tape, fiber washers and certain forms of metallic packing. Corset lace and wicking seem to be the most common. It is Navy practice to use corset lacing soaked in paraffin, tallow, mineral oil or boiled linseed oil and then squeezed dry by hand. Under particularly unfavorable circulating water conditions, where fabric and even fiber packings have deteriorated rapidly, metallic packing is being tried out. Such metallic packing consists of rings built up of many spiraled layers of thin babbitt foil, so that, while they are of metallic construction, they are at the same time flexible and slightly plastic.

Fabric packings must not be drawn up too tight, especially where soft metal tubes are used, because of the danger of crushing the tube. The packing should, furthermore, allow a certain amount of longitudinal movement of the tube which results from expansion due to temperature changes.

◆ Detecting Air Leaks in a Boiler Setting

One should assume that every crack in a boiler setting is conducting air to the heating surface, and check over each one with a candle while the draft is on furnace. Be sure to try the candle around eye-beams or stays, tube blowing openings and door frames, also along the side of the drum at the top of the setting. These points are seldom airtight for any length of time, owing to the expansion and contraction of the boiler and setting, and require frequent attention.

Another method of detecting air leaks is to keep the setting whitewashed and the leaks will be readily seen by the accumulation of dust around the opening. Another method, and one that is frequently used, is to close the damper in the breeching suddenly just after freshly charging the fire with coal. Smoke will then issue from all cracks or openings that are detrimental to the operation of the boiler.

◆ IT IS ALWAYS good practice to use tees or crosses instead of elbows in bends in the feed-piping, so that the pipes may be easily washed and cleaned.

◆ Erecting Piping

Piping should be erected so that no water pockets will be formed, and if this cannot be avoided, liberal-sized drains should be provided. Drains should also be placed at the bottom of risers, lowest points of reducing flanges and tees and at any point where water is liable to collect from the closing of a stop valve. Where possible, steam lines should have a grade of at least 1 in. in 50 ft., and better drainage is obtained if the fall is is in the direction of the steam flow. The necessary allowance should be made for expansion and contraction, and the lime should be amply supported and anchored.

Piping should always be accessible for safety and economy; the accessibility possible should be a factor in the selection of a piping system because it affects the time required for repair and therefore the reliability of plant operation.

◆ IN PLACING rubber packing joints together, use either graphite or chalk to prevent the rubber adhering to the metal when the joint is to be broken.

◆ THE FREQUENCY of blowing down a boiler is determined by the class of feed water used, and the proper time for blowing down is governed by the periods at which there is the least demand for steam. If a boiler is placed on bank over night, it should be blown down in the morning before starting up the fire; in any case the blowing down should be done when the boiler is least active. Where the boilers are operated continuously for long periods, some means, such as a continuous blown-down system, should be provided for removing the impurities from the water before it enters the boilers.

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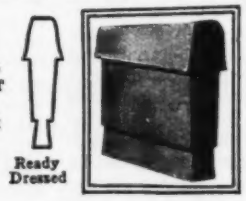

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Division I—Paper and Pulp Mills

	PARTICIPANT	MILL	LOCATION
GROUP A			
GROUP B	St. Croix Paper Co.	Woodland	Maine
GROUP C			
GROUP D	International Paper Co.	Riley	Maine
	Hollingsworth & Whitney Co.	Abenaquis	Madison, Me.
	Spaulding Fibre Co., Inc.	Hayes	No. Rochester, N.H.

Division II—Remanufacturing

Container Corp. of America	Natick	Massachusetts
Southern Container Co.	Houston	Texas

IMPERFECT SCORES

	Key	Rank	Points Credit	Points Debit
GROUP A	PA- 6	1	882.330	
	PA-17	2	777.208	
	PA- 2	3	718.530	
	PA- 1	4	628.472	
	PB- 5	5	556.838	
	PA- 5	6	554.504	
	PA- 8	7	554.470	
	PA- 4	8	472.476	
	PA- 3	9	424.066	
	PB- 2	10	248.016	
	PA-14	11	202.670	
	PA-13	12		164.106
	PA-12	13		237.640
	PA-15	14		297.306
	PA-16	15		439.370
	PA- 9	16		914.096
GROUP B	PB- 9	2	900.038	
	PC-10	3	785.744	
	PB- 6	4	748.266	
	PB- 1	5	733.570	
	PB-15	6	684.666	
	PB- 7	7	637.686	
	PC- 7	8	617.152	
	PB- 3	9	558.046	
	PC- 9	10	492.636	
	PB-16	11	382.942	
	PB-11	12	324.334	
	PB-14	13		8.834
	PB- 4	14		143.322
	PB-13	15		152.962
	PC- 2	16		275.280
	PC-19	17		1,359.554

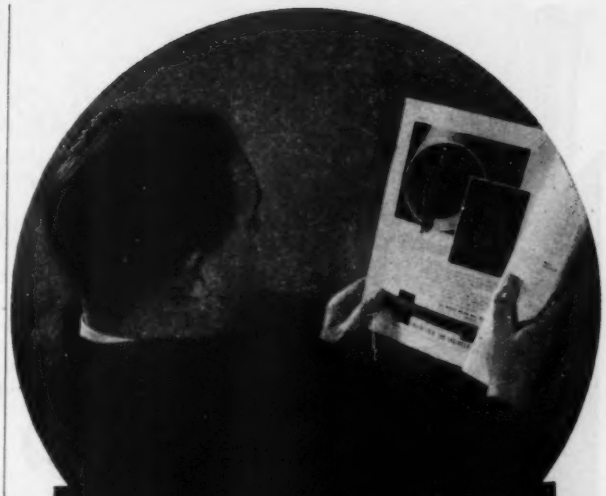
DIVISION II

RB-1	3	807.890	
RD-4	4	304.450	
RC-1	5	783.294	
RC-5	6	686.982	
RD-1	7	686.080	
RD-5	8	576.022	
RD-6	9	508.526	
RC-4	10	465.594	
RC-2	11	426.632	
RC-3	12	37.002	
RD-7	13		960.888
RD-3	14		1,047.970

	Key	Rank	Points Credit	Points Debit
GROUP C	PC- 6	1	921.530	
	PC-22	2	757.010	
	PD-28	3	722.696	
	PC-14	4	687.386	
	PC-25	5	651.296	
	PD-17	6	565.416	
	PC-11	7	492.342	
	PB-10	8	437.086	
	PB-17	9	398.864	
	PC-15	10	377.582	
	PD-25	11	364.440	
	PC-24	12	332.040	
	PC- 8	13	307.444	
	PD-13	14	307.046	
	PC-18	15	295.504	
	PC-20	16	261.908	
	PC-21	17	122.938	
	PC-23	18	111.872	
	PD-14	19		16.158
	PC-12	20		22.496
	PC-16	21		79.126
	PC- 3	22		632.488
	PC- 4	23		670.866
	PB-18	24		947.354
	PC-26	25		1,040.650
GROUP D	PD-15	4	826.746	
	PD- 4	5	855.416	
	PD- 1	6	763.104	
	PD-27	7	730.530	
	PD- 6	8	676.934	
	PD-26	9	601.422	
	PD- 9	10	582.590	
	PD-18	11	495.512	
	PD- 3	12	364.522	
	PD-24	13	167.664	
	PD- 7	14		58.934
	PD-12	15		72.074
	PD- 8	16		126.310
	PC-13	17		211.406
	PD-20	18		479.664
	PD-11	19		883.074
	PD-29	20		966.808
	PD- 2	21		1,100.732

Withdrawn: PA-1, PA-10; PB-8, PB-12; PC-5, PC-17; PD-21, PD-22, PD-23.
No April Report: PD-10.
No March or April Report: PC-27.

◆ THE SAFETY CONTEST among the mills of the Paper and Pulp Section of the National Safety Council will end June 30, when another year's contest automatically begins. The rules for the new contest which will be mailed to all members by July 1, carry some decided changes over the rules of previous contests. Two important changes are: equal awards will be granted to perfect scores in the same group; (b) the severity and point scoring system will be eliminated, and the contest will be conducted on a frequency basis, putting the contests of the section on the same basis as all other contests conducted by the Council.



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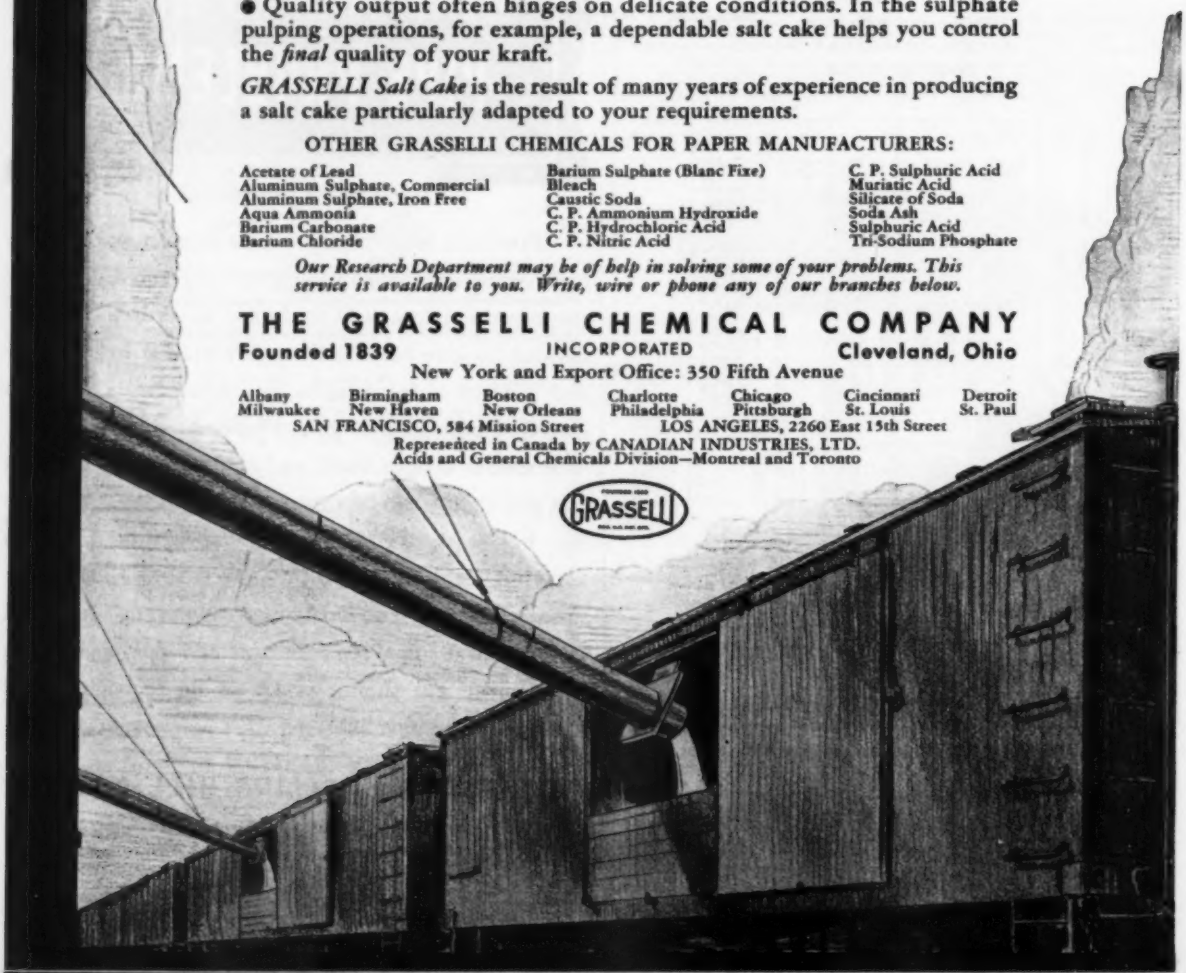

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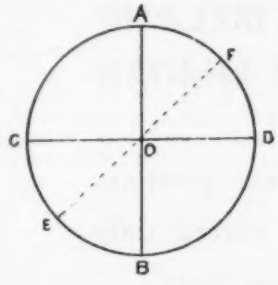
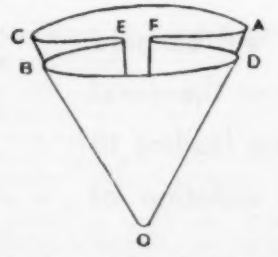
IN THE PAPER INDUSTRY ■ DOMESTIC AND FOREIGN

The following abstracts are of the latest developments found in the foreign press and in the patent offices. Photostats and translations of complete articles and patents can be obtained at cost price.

◆ Waterproofness of Paper

The tests that are described in detail, deal with penetration, absorption and diffusion. Strength tests are made in the usual way, first on dry samples, then on those that have been water-soaked for 12 hours. The wet strength is recorded in terms of percentage of the dry strength of the same sheet. In penetration tests, the paper itself is made up into the form of a shallow tray, which is then half-filled with a dye solution. The tray rests on white blotting paper, which, in turn, is placed on a glass plate. Thus tiny pinholes rapidly become visible. The dye solution should not seep through within 12 hours. In another

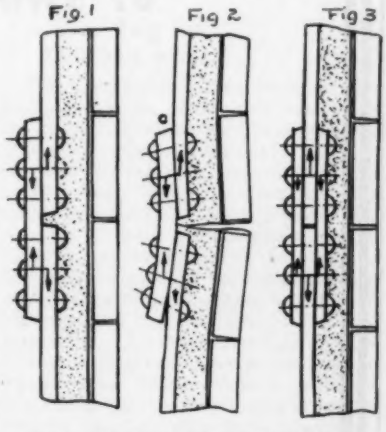




very simple penetration test, the paper, cut in the shape of a circle 12 inches in diameter, is specially folded as illustrated, placed in a glass funnel, filled to a depth of 4 inches with water or dye solution, and the penetration noted. If this is appreciable, the actual volume of liquid passing the filter within a given time may be measured. The simplest absorption test consists of weighing a square foot of the dry, waterproof paper, immersing it in water in a shallow tray for 12 hours, and then reweighing the sheet after the removal of superficial moisture. Absorption is recorded as the gain in weight. Accurate diffusion tests are best carried out in a constant humidity room. Failing this, the diffusion may be gauged by the following very simple method: Flat, cylindrical tinplate boxes, about 4 inches in diameter, and 1 inch in depth, are used. Clean circular holes 3-4/7 inches in diameter are cut or punched through each lid without distorting its shape. The paper to be tested is cut circularly to fit the inner diameter of the tin cover, but is inserted between and held in position by 2 thin rubber washers placed inside of the lid. The inner diameter of these washers is identical with that of the circular lid—opening referred to above. Thus the area of the paper surface exposed both to the air within and without the box closely approximates 10 sq. in. Saturated air is maintained within the box by means of moist, pressed pulp. The box itself (plus the paper, washers, and pulp) is weighed and placed in a dessicator. The moisture diffuses from the interior, through the paper membrane, and may be quantitatively estimated by noting the loss in weight every 12 hours over a certain time period. Paper Mill Chemist. Paper-Maker and Brit. Trade J., 87, No. 3, (Technical Supplement) 66-7 (1934).

◆ Digester Linings

In a thorough resumé of the development of linings for various types of chemical digesters, the author (in an address before the Silesian Section of the Verein der Zellstoff u Papierchemiker u-Ingenieure, held in Oct., 1933), emphasizes especially those linings used in pulp digesters. The usual type of steel plates, joined at the seams of the digester with rivets as shown in Fig. 1, are sometimes deformed as illustrated in Fig. 2, due to this unsymmetrical arrangement. Accordingly, the technique for sealing seams in the digester shell, indicated in Fig. 3, has been devised. Here an inner and an outer plate are used, so that the stresses are taken up symmetrically. The plate thickness here is considerably reduced, hence the actual cost of steel is lower than that where single plates are used. Lineal heat expansion differences between iron and the lining material are also of great importance. Ordinary iron expands about 1.1 mm. per meter at 100 deg. C. This is referred to as an expansion number of 0.011. The digester brick lining shows an expansion number of about 0.0025 or roughly ¼ that of the shell. (The above relative data should probably be modified slightly by more recent investigations which are still incomplete, but the fact remains that the binding material must take up these differences in stress.) Most digesters in Germany still have lining of cement between the steel shell and the acid-resistant brick. Attempts to introduce iron into this cement by the old Kupka process were abandoned and are now obsolete. The mortar used for laying the inner brick is of the utmost significance. After discussing litharge-glycerine and the so-called Turkish mass, attention is drawn to the advantages of the Höchst acidproof mortar, in which a cement meal is added to water glass. The components of the meal react with the alkali of the sodium silicate, thus hastening the separation of hydrated silicic acid. Among these sodium siliconfluoride ranks as one of the best. These mortars are termed self-hardening, and have given excellent, long term service. A disadvantage is that the mortar can only be mixed in relatively small batches, and that the ratio of cement powder to water glass must be kept within rather narrow limits. One of the other recently devised binding materials is the so-called asplit (Cf. THE PAPER INDUSTRY 15, No. 9,531 (1933)), which belongs to a group of artificial resins. Its utilization is more troublesome than that of the Höchst mortar, but its acid resistance when properly applied is unsurpassed.



Asplit is therefore recommended for use in those parts of the digester that have to meet unusual demands during the cook. In the case of the (non-German) Welhaven method of lining, the cement wall intermediate between the shell and the brickwork is dispensed with. A water glass which is here used as the mortar is a highly concentrated solution of 48 deg. Bé., instead of the usual concentration of 38-40 deg. Bé. In this mortar, no exact ratio of cement powder to water glass is employed, but there is always a marked excess of the latter. During the period of lining or relining, special openings are left in the digester shell, and when the water glass no longer comes through these, they are hermetically sealed by means of screws. The Welhaven process despite its apparent simplicity places the greatest responsibility on the competence and experience of the laborers lining the di-

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gesters. Ordinarily, two layers of relatively thin bricks are used, and the actual capacity of the digester is often greater than when other lining methods are used. However, heat losses are increased. Chief Engineer Kruse. Papier-Fabr. 32, No. 12,133-5 (1934).

◆ Motion Photomicrographs of Fiber Swelling

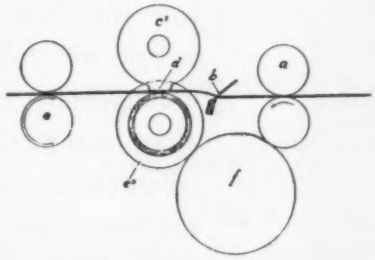
Motion pictures were taken of the swelling (hydration) of cellulose and wool fibers, and of starch grains, and the technique is fuly explained by the writer. Various grades of cotton cellulose were used and a mixture of cuprammonium and sodium hydroxide solutions was employed as reagent to induce swelling. An analysis of the sucessive photomicrographs, a number of which are reproduced in the article, indicates that the mechanism of fiber swelling involves at least four types of phenomena: (1) penetration of the liquid into the interior through the outer cuticular layer; (2) chemical interact-between this liquid and the inner substance of the fiber; (3) solution of the inner portion of the fiber; (4) a subsequent pouring in of the outer solution, with the possible, final rupture of the outer skin of the fiber. Two stages appear to be of great importance. In the first stage, chemical changes predominate. They are synchronized with increase in volume and shrinkage in the length of the fiber, and with the acquisition of elastic and plastic properties. In the second stage, solution occurs, which owing to the marked resistance of the outer layer, is prevented from extending into the outer liquid. The author emphasizes the impossible difficulties arising if attempts are made to apply his findings to the chemical constitution of cellulose. Kurt Hess; Papier-Fabr. 32, No. 6, 61-7 (1934).

◆ Properties of Regenerated Waste Paper

The changes in physical properties resulting from the reclamation of paper have been studied in two parallel series of experiments: with paper pulp and the resultant original newsprint (containing 16 per cent chemical and 48 per cent mechanical pulp) and with the regenerated newsprint. In the latter, the losses in tensile strength, stretch, bursting strength, and tear resistance are lowered respectively 6.1, 15.5, 15.8, and 9.7 per cent. The depreciation of paper due to printers' ink is discussed together with deinking methods (which were often of technical rather than economic interest). Deinking liquors contained, in solution or suspension, combinations of caustic soda, washing soda, magnesium silicate, calcium silicate, magnesium carbonate, and bentonite, as well as certain products obtained in sulphate pulp manufacture like lime sludge and resin soaps. Finally the degree of whiteness (as compared with barytes and with the unused newsprint as standard) resulting from the use of various deinking preparations was determined. The whitest paper was obtained by deinking with the following combination: 20 grams paper in aqueous suspension, 0.5 per cent sodium hydroxide, 30 per cent resin soap (by product), and 10 per cent bentonite, working at 90 deg. C. Despite the lowering of strength in the regeneration of waste papers high in mechanical pulp, the process is entirely feasible from the technologist's standpoint. However, whether such regeneration actually pays is a moot question, depending on the price of halfstuff and paper and also on the site at which production is carried out. In Finland, such regeneration is hardly expedient. The reservicing of papers free from mechanical pulp presents fewer difficulties, since owing to its greater strength, a much more drastic treatment may be used. E. von Pfaler; Pappers-Trävarutid, Finland, 15,562 (1933); through Papier-Fabr. 32, Vol. 1, 9 (Jan. 7, 1934).

◆ Device Used in Bag Manufacture

The accompanying illustration shows a regulating device used in the handling of paper tubes to be manufactured into bags. In the figure, (a) indicates the upper of two guide rolls between which passes the flattened tube, that is cut into suitable lengths by the cutter (b). Following this are the rolls designated as (c^1) and (c^{11}), the upper one of which is provided with the projection (d) that, during a single revolution of (c'), makes contact only once with the lower cylinder (c''). The rolls (e) then pick up



the sections of paper tubing, conveying them towards that part of the machine where they are to receive further treatment. The device (f) transmits the movement of the rolls (a) to (c') and (c''), and in such fashion that these latter have a peripheral speed approximately 30 per cent slower than that of (a). Only periodically do (c') and (c'') play a part in the transmission of the paper tube. It is only at the particular moment at which the cutter (b) is ready to function that a contact is made between (d) and (c''), and it is only then that the tubing is acted upon by these rolls, through which it travels at a markedly reduced speed. Societé C. and A. Holweg. French Patent No. 739,-011.

◆ pH in Volumetric Analysis

An address before the Congrés de la Cellulose, in Oct. 1933. After reviewing certain theoretical considerations, and the methods used in titrating strong acids and bases, and weak acids and bases, the author deals with the application of the present day pH indicators in modern pulp mill control work. For example, he gives the neutralization curves of 0.1 molar solutions of NaOH, of Na_2CO_3, and of Na_2SO_3 and goes into the details of titrating various mixtures. While these data present nothing fundamentally new, they have a certain practical interest. A single example (one out of eight) will suffice. To determine $NaHSO_3$, 10 cc. of the liquor are diluted with 40 cc. of water, and treated with several drops of helianthin and of thymolphthalein. Standardized NaOH is then run in until the pH 4.4 (helianthin orange) is reached. At this point, all the sulphite is present as $NaHSO_3$. Subsequently the standard NaOH is run in up to the point pH 9.5, where all the sulphite is in the form of Na_2SO_3. If the volume of normal NaOH used in the first titration is termed (x) and that used in the 2nd. titration (y), then the total percentage SO_2 equals 0.64 (y), and the free SO_2 equals 0.32 [(x)+(y)]. The percentage combined SO_2 is the difference between these values, and naturally the Na present in the original liquor may be calculated from this last figure. Acid liquors containing Ca bisulphite may be titrated similarly. André Nicollet Mon. Papeterie Francaise, 71; No. 4, 86-90 (Feb. 15, 1934).

◆ Wood Pulp for Cellulose Acetate

The prerequisites that must be met before chemical wood pulp can prove an industrial substitute for cotton linters are outlined. In the main, research workers dealing with the problem seem to have been lacking in practical pulp-making experience. Spruce wood pulp appears the most suitable raw material. Unusual precautions must be taken in the initial stages of the delignification of wood not to injure those qualities of the cellulose that are essential to the formation of a suitable cellulose acetate. Direct acetylation of wood leads to no useful end. Furthermore, the direct acetylation of the usual grades of untreated sulphite pulp gave unsatisfactory results. In general, alkaline pretreatment of the sulphite pulp appears advisable. Acid treatments are not excluded but seem much less satisfactory. For example, by heating with 6 per cent NaOH or even on treatment in the cold the non-cellulosic materials were lowered (in one instance) from 4 per cent to 1 per cent. The simultaneous action of NaOH and of oxidizing agents which might well destroy the impurities in the pulp is dangerous owing to oxidizing and hydrolyzing effects. Even alkali-pretreated chemical pulps, showing marked similarity by the usual tests, often show differences in their ease of acetylation. Further treatment is often indicated. For example, a Finnish (so-called) Dreikronen pulp, after pretreatment with dilute alkali, and subsequent acetylation, gave a very uneven cellulose acetate (showing 49.8 per cent acetic acid). However, if this

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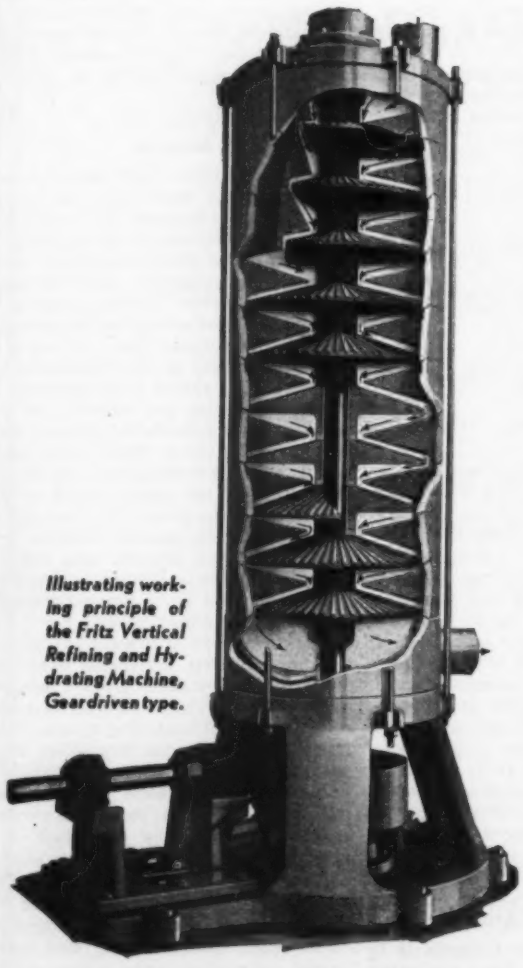

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same alkali-treated pulp was further acted upon by aqueous sodium bisulphate, containing 3 grams per liter of acetic acid, and then acetylated, a uniform, technically serviceable cellulose acetate, containing 54 per cent of acetic acid was obtained. The author points out that the physical properties of the pulp are of even greater importance than the chemical properties, where acetylation is concerned, and that the conditions of acetylation are of the utmost significance. Treatment of wood with alkaline solutions prior to the sulphite cook proved unsatisfactory, while pretreatment with organic solvents, especially alcohol, appeared useful. Another technique, although less satisfactory than alcohol involved treatment of the original wood with NaOH (of 1 deg. Bé) followed by exact neutralization with acetic acid. The subsequent sulphite cook presented no difficulties, and the resultant pulp was easily converted into a satisfactory acetate. Other types of experiments are also described. Soda pulp, without further treatment, leads to difficulties in acetylation similar to those encountered with sulphite. Straw pulp was more readily acetylated than that from spruce sulphite. Scots pine, fir, and beech pulps proved unsuitable. It appears that even at present, certain German acetate manufacturers are in a position to supply satisfactory cellulose acetates from wood pulps, the costs of which compare favorably with those produced from linters. Fritz Ohl. Papier-Fabr. 32, No. 10,114-6 (1934).

◆ Laminated Cellulose Pads

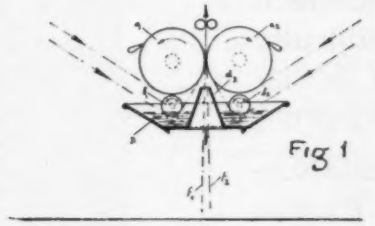
This invention of Les Papeteries de la Robertsau, in Strassburg-Robertsau, uses as principle a pad of cellulose wadding, sized and water-repellant on one or on either surface, joined with pads of highly absorbent pulp tissue. In this way a pulp pad is built up which is partly absorbent, partly impervious to water and which possesses the same softness, pliability and resistance as the ordinary pads now used for hygienic purposes. German Patent No. 588,954, Kl.55f.

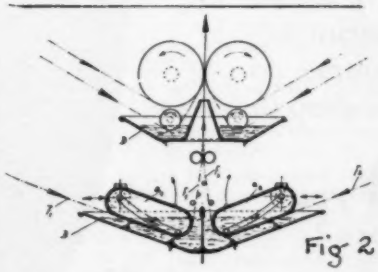
◆ Bleaching of Cellulose Fibers

The bleaching depends on the use of caustic soda and chlorine gas, and the invention uses these reagents together (in the presence of the cellulosic suspension) then alternately, finally together again, in a way that is dependent on the desired hydrogen-ion concentration and on the desired type and concentration of the bleach liquor. The following example is cited: 1160 kg. of air dried sulphate pulp made from Scotch pine are suspended in water in a poaching engine, and then treated during the course of an hour with 47.4 kg. of a 32.5 per cent caustic soda solution. Simultaneously chlorine gas is passed into the mixture, but the passage of gas requires a total of 4.5 hours, and an addition of 49.4 kg. If, at the end of this time period, 100 cc. of the liquid are neutralized by 2.88 cc. of a 0.1 Normal NaOH solution, the pulp is washed. Thereupon another 47.4 kg. of caustic soda solution are gradually added to neutralize the acidity of the fibers. Subsequently chlorine gas is passed in at such a rate that 27.2 kg. make contact with the suspension in the course of 4 hours. The resulting, air-dried, bleached pulp is pure white, very strong, and weighs approximately 1000 kg. Dr. Roland Runkel, Weinheim, Baden. German Patent No. 591,111; Kl. 55c.

◆ Parchmentizing, Coating, or Gluing Device

The claim is made that by means of the equipment, one or more paper sheets may be treated very rapidly with liquids of varying types and different concentrations. In Fig. 1, the apparatus consists of suitable press rolls, wringers or guide rolls a_1 and a_2 and below these a trough D, equipped with smaller rolls b and b_1. This in turn is provided with a slit-like opening, d_3, the sloping sides of which are higher than the upper rim of the trough. This permits the continuous passage of the paper sheet or sheets F_1 and F_2, through the agency of 2 slide valves (not shown) running in the direction of the slit and connected with the lower end of the opening. A second patent supplements the first, as shown in Fig. 2. Here below the first trough D, is a second trough B, also containing the solution with which the paper is to be treated. B is provided with two swinging suction devices a_1 and a_2, over the surfaces of which the sheets F_1 and F_2 are drawn. Carl Wagner. German Patents No. 593,700 and No. 593,701.





◆ Sodium Displaces Lime in Cooking Acids

The replacement of calcium by sodium in acid cooking liquors as suggested by Hägglund in cooperation with Patentaktiebolget Gröndel-Ramen is now practiced on a large scale in Norway, although exports of pulp by the sodium bisulphite process are not comtemplated at present. Its advantage over the usual sulphite process includes the possibility of using pine (which is 20-25% cheaper than spruce) as raw material. The regeneration of acid presents no difficulties (although the method is not given in the abstract), and mills need no longer be located on large streams or near the coast, but may be closer to the base of supply of the raw materials. Anonymous; Oesterr. Zentr. Papierindustrie, 51, 151 (1933); through Papier-Fabr. 32, No. 4, 45 (1934).

◆ Colloidal Properties of Spruce Wood

The author takes up the colloidal changes occurring in wood, from the time that the tree is felled and partially barked through those technoligical phases at which electrolytes enter the wood substance and cause swelling. Schwalbe's approach to his subject is always made from a practical standpoint, and much of the material has been published previously. While part of his work is of vital interest to all branches of the lumber and wood-using industries, many of his data are especially interesting to papermakers. Two types of air-drying of wood may result from climatic conditions: (1) a steady drying due to uniform weather, and (2) an oscillatory drying due to changeable weather conditions. The second type seems more ideally suited to most subsequent technological operations; but not to pulp manufacture, since colloids which have alternately swollen and shrunk, gradually reach a stage at which the process comes to a halt, and at which the material is no longer elastic and absorbent. A simplified constant recording device indicating the swelling and shrinkage of the wood is described, as well as the moisture chamber in which experiments on relatively small pieces of wood are carried out. The time of storage has a marked effect on swelling. For example at 92 deg. humidity, ash wood shows definitely a decreased maximum swelling with length of storage. The penetration of water into wood varies with the state of dryness. For example, in bone-dry wood there is no appreciable difference in penetration into heart or sapwood of spruce or pine, but in green or air-dried samples there are marked differences, the heartwood taking up less water. The author also discusses very briefly the adsorption and the penetration into wood of electrolytes, and the difficulties in measuring the resultant swelling. Apparently the best method of removing air from wood, so as to permit penetration, is found in the use of a tumbling barrel and by using relatively small amounts of water or the solutions used in cooking. With this technique, in general the more concentrated the solutions, the more rapid the penetration. The author also calls attention to the importance of washing fibers by using the method of displacement washing for the gradual and thorough removal of chemicals rather than the diffuser method. Carl G. Schwalbe; Papier-Fabr., 32, No. 3, 25 (1934).

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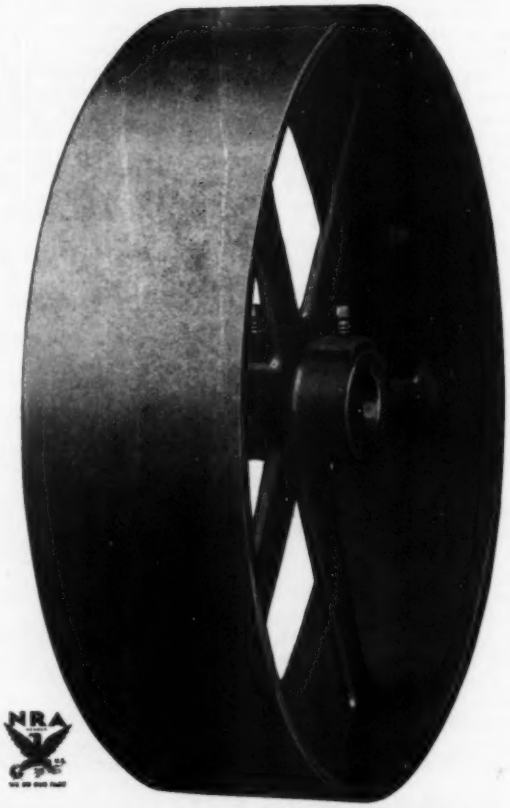

because in **Paper and Pulp Mills** there are heavy loads and hard pulls—intermittent and shock loads—wet places and dry places —and a **Cast Iron Pulley** is the only type that will stand up under all conditions.

All of our appliances—Pulleys, Couplings, Pillow Blocks, Friction Clutches, "V" Belt Drives, Rope Drives—are designed for heavy duty Paper and Pulp Mill service.

T. B. Wood's Sons Co.
Chambersburg, Pa.

The COMMERCIAL OUTLOOK

New York, June 1, 1934.

THERE are numerous signs that activity in the paper industry has tapered off quite considerably. There are plenty of reports from various quarters within the industry that this is true. There have been developments, both outside and within the industry, which have unquestionably lent their influence toward this quieter situation.

At the same time, it can be said, and in all likelihood without anyone in the industry rising to dispute it, that the paper market is not as slow as many reports have pictured it or as many individuals connected with the industry have been prone to say is the case. In short, the adverse views concerning the market have been somewhat exaggerated; there has been recently, and still is, a disposition among paper manufacturers, mill agents and jobbers to paint the market condition just a little more unfavorable than it would appear actually exists.

Paper consumers and converters, as well as merchants and distributors, have unmistakably let down in their buying. A more cautious atmosphere prevails throughout the market. Orders are being placed, of course, and in fairly consistent fashion, yet numerically and from a volume standpoint commitments do not begin to measure up to the level seen some time back. Probably one important reason for this is the season of the year. The summer is proverbially a quiet period for the paper consumer and the paper industry, and there appears no basis for the expectation that the coming hot-weather months are going to be any exception this year. Futhermore, there are indications that papers users have in many cases stocked up, so that they can well afford to refrain from purchasing for a time. Also, outside influences seem to suggest caution in the absorption of additional supplies. Much uncertainty has developed in the general business situation. Labor troubles in some industries, declining commodity prices, the exceedingly slow securities markets, Congressional activities in Washington and other factors all have cast their effect—and mostly of adverse character—on general business, and it stands to reason that the paper industry has not escaped, particularly since paper business is so dependant on so many other branches of trade and industry.

Reports seem to reflect a varied and spotty condition in the paper industry as a whole. Some mills are said to be operating on an active scale; others to have found it necessary to curtail production substantially. In certain instances manufacturers have shut down their plants for a week or more at a stretch owing to a falling away of orders. It would appear that some groups of mills are much busier, depending on the class of paper produced, than others, with some groups feeling the market quietness relatively severely. By way of illustration, newsprint mills are reported running at a better rate of capacity than in a long while, and on the other hand, boxboard mills are experiencing distinct dullness in their market and have cut production down to three days a week in many cases.

Sentiment within the industry, on the whole, is encouraged. Some members of the trade are bold enough to predict a mild boom in the paper market in the autumn, and majority opinion is that business will show substantial expansion once the summer dullness is over. The feeling is general that the summer will witness the dissipation of much of the uncertainty now existing, thus laying the groundwork for business generally to move forward in the late months of the year.

Production of newsprint in the United States and Canada in April continued to run far ahead of the corresponding period last year, the output in the two countries exceeding that of a year ago by 35 per cent, with Canada showing an increase of 46.5 per cent, according to figures compiled by the News Print Service Bureau. The gain for the United States was 12.2 per cent. The Canadian output was the largest for any month since July, 1930.

United States mills produced 83,652 net tons of newsprint in April, compared with 84,993 tons in the preceding month and 74,507 tons in April last year, while output in Canada was 216,507 tons, against 210,129 tons in March this year and 147,759 tons in April last year, making a total for the two countries of 300,159 tons, contrasted with 295,122 tons in March this year and 222,266 tons in the similar month a year ago. During April production in Newfoundland amounted to 25,311 tons and in Mexico 1,616 tons, so that the total North American output reached 327,086 tons, compared with 321,187 tons in March last and 242,493 tons in April, 1933. Shipments of newsprint from mills during April amounted to 86,209 tons in the United States and 220,573 tons in Canada, a total of 306,782 tons, compared with 295,184 tons in the preceding month and 237,361 tons in April last year. Newsprint stocks at mills at the end of April amounted to only about one-fifth of a month's production, but the Bureau has discontinued the table showing stocks comparisons.

Paperboard production in the United States in March last reached 254,819 net tons, showing a large increase over the 223,366 tons manufactured in the month before, and also a rise over the 237,536 tons in the corresponding month in 1933, according to the U. S. Department of Commerce monthly review. Production during March was at 64.1 per cent of mills' rated capacity, against 63.5 per cent in the preceding month and 54.9 per cent in the same month a year ago. Production in the first three months of this year totaled 708,496 tons, compared with 648,733 tons in the similar period last year.

New orders for board received by manufacturers in March called for 264,985 tons, against 234,318 tons in the month preceding, while unfilled orders held by mills at the end of March were for a total of 86,033 tons, contrasted with 75,143 tons a month before. Shipments of board from mills in March aggregated 221,114 tons, against 192,685 tons in the month before, and stocks on hand at mills at the close of March amounted to 79,372 tons, compared with 77,982 tons at the end of February last.

◆ ◆

◆ Peninsular Paper Has New Superintendent

John P. Cooney, who has been general superintendent of the Peninsular Paper Co., Ypsilanti, Mich., for over thirty years, has resigned because of ill health. He will be succeeded by C. Harry R. Johnson, of Whitford, Pa. The directors, however, announce that Mr. Cooney will be retained as a consultant superintendent for the time being.

Mr. Johnson has had considerable experience in the paper mill field, having become associated with the Beckett Paper Co., Hamilton, Ohio, shortly after graduating from Massachusetts Institute of Technology. After seven years with Beckett he became associated with the Scott Paper Co., Chester, Pa., as engineer. Since 1930 he has been connected with the Downingtown Manufacturing Co., Downingtown, Pa.

◆ ROOTS-CONNERSVILLE Blower Corp., Connersville, Ind., is now supplying some of its blowers, vacuum pumps and gas pumps connected through a variable speed drive to a constant speed motor. It is pointed out by the manufacturers that where variations in the volume are required, a unit of this type offers many advantages in the process industries.

◆ JOHN F. JOSEPH, formerly vice president and general manager of the Cincinnati Rubber Mfg. Co., Cincinnati, Ohio, was elected president of the company at a recent meeting of the board of directors. The company has recently appointed Buffalo Rubber and Supply, Inc., Buffalo, N. Y., and the Tennessee Belting Company, Tenn., new distributors for its products.

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Unexcelled for strength, openness, resiliency, and general running qualities. Made to meet the most exacting conditions on all types of machines and all kinds of papers. Only one grade and that the highest.

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CANTON, MASS.

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PACIFIC SALES COMPANY, Security Bldg., Portland, Ore.

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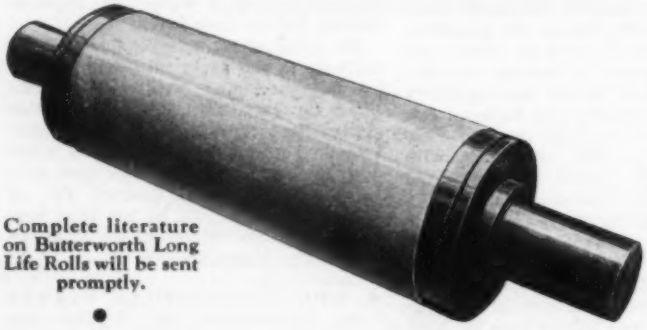

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Domestic RAW MATERIALS

◆ Papermaking Rags

It is generally agreed among dealers that demand from paper manufacturers for rag stock is slow. Only one class of such material seems to be moving with any consistency or in sizable volume and that is roofing rags; otherwise, mills are manifesting limited interest in the offerings made to them and are placing orders only in very spasmodic fashion and even then for comparatively small lots of rags. Writing paper manufacturers in New England and elsewhere are reported engaging in noticeably restricted purchases, book paper and specialty mills are absorbing but few rags, and the market as a whole is of truly narrow dimensions from a selling outlet standpoint.

Roofing felt mills are acquiring needed supplies in an orderly manner and therefore prices are simply holding their own. However, it is evident that consumption of rags by this group of manufacturers is fair; certainly it has increased over that witnessed for so many months, and the outlook in this connection is bright indeed. With the Government planning to lend many millions of dollars for residential construction and for home repairs, the likelihood is consumption of roofing felt will register a substantial gain in the months to come, so that felt mills should procure a great deal more business. Already felt manufacturers are enjoying a better market for their product and have found it necessary to purchase rag stock in a steady way.

Rags for writing paper manufacture are tending downward in price; at any rate, it is plainly evident that some grades of new cotton cuttings are available at lower prices than prevailed recently, which seems due to nothing else than the slow demand that has come from consuming quarters. Production of cuttings has declined, owing to a slowing down of operations in the clothing manufacturing field, but this factor has waged scant influence because of the limited buying by paper mills. The strongest phase of the cotton cutting market is that exportations from this country to Europe are assuming important proportions.

Reports say that No. 1 new white shirt cuttings are available to mills at 6.25 to 6.50 cents a pound f. o. b. dealers' shipping points, fancy shirt cuttings at 2 to 2.25 cents, washables at 1.75 to 2 cents, soft unbleached muslins at 7 to 7.25 cents, blue overall cuttings at 4 to 4.25 cents, light silesias at 4 to 4.25 cents, black silesias at 3 to 3.25 cents, and khaki cuttings at 3.75 to 4 cents.

Roofing rags are selling freely in the East at 1.10 to 1.20 cents per pound for No. 1 domestic roofing stock and around 90 cents a hundred pounds for No. 2 stock f. o. b. shipping points. Prices in the Middle West are close to these same levels. Few lots of such rags are being imported, as has been the case in recent months, since market price levels abroad are well above a parity with those prevailing here. Manufacturers therefore are having to draw principally on the domestic supply to fill their needs. Other old cotton rags are quiet, and uncertain in price, there being little call for old whites or thirds and blues from paper mills. No. 1 repacked whites are variously quoted at 2.50 to 3.25 cents a pound at shipping points, depending on quality, while repacked blues are reported at about 1.25 cents a pound.

◆ Rope and Bagging

Neither old rope nor scrap bagging are exhibiting much market activity. Paper manufacturers evince little interest in these materials, and seem to be procuring the small supplies wanted at prices altogether in their favor. The nominal market level on old rope is 2.50 cents a pound f. o. b. shipping points for No. 1 domestic old manila, and 2.25 cents ex dock New York for No. 1 foreign old manila rope, yet it is admitted by dealers some sales are being made below these figures. Scrap bagging is approximately 1.20 cents a pound for No. 1 domestic packing, and 60 to 65 cents a hundred pounds for roofing bagging, but these prices are mostly quotations and in all probability could be bettered by shrewd buyers. A feature in bagging is that prices on imported material are generally above those quoted on domestic stock, reflecting a higher market at supply sources abroad.

◆ Pulpwood

Little change is reported in pulpwood, the market being characterized by moderate activity of routine nature, and quoted prices holding to steady levels.

◆ Mechanical Pulp

While a fair demand exists for mechanical wood pulp, little supply of domestic origin is reaching the market, the trading now current being confined very nearly entirely to Canadian or European groundwood. The explanation is, so reports say, that domestic producers have need for practically all of their output, and therefore are directing little tonnage for sale purposes in the open market. The price tone is steady though changes of consequence have been lacking recently. Canadian groundwood is quoted at $25 per short ton ex dock American Atlantic seaboard for moist pulp brought down by vessels, figuring out at anywhere between $29 and $33 a ton delivered consuming mill sectors. Domestic groundwood is on a quotable basis of around $26 or $27 a ton f. o. b. pulp mills.

◆ Chemical Pulp

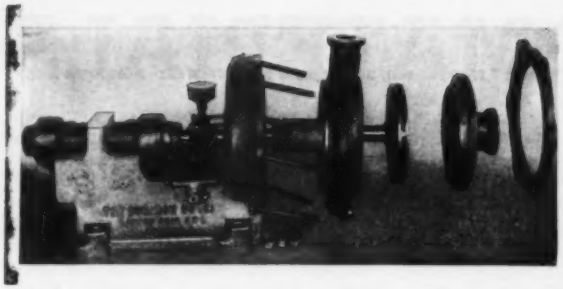
The market for chemical wood pulp has slowed down quite perceptibly. There is nothing like the buying interest that was apparent up to a few weeks ago, and a salient reason seemingly is that a majority of consumers are well contracted on supplies, have ample stocks on hand or on order and are not disposed to add to their commitments with the summer coming on and owing to the uncertainty existing in the paper market at present. Most producing mills are well booked up, however, and are operating at a fair scale of capacity. Moreover, quoted prices are maintained and are marked by firmness of tone. Domestic bleached sulphite is on a quotable level of 2.75 cents per pound ex dock American Atlantic seaboard, with high grades ranging up to 3 cents and more. Unbleached sulphite is 2.10 to 2.20 cents a pound for the ordinary prime qualities, and 2.25 and 2.30 cents for easy bleaching and Mitscherlich grades. Bleached soda pulp is 2.50 cents a pound delivered book paper mills, while domestic kraft pulp is quoted from 1.75 to 2 cents at pulp plants.

◆ Chemicals

Casein prices are firm of tone with 12.50 to 13 cents a pound asked for domestic, according to the grind, and 15.50 to 16 cents for the imported product, duty paid basis. Demand for soda ash is reported fairly active and 1.30 to 1.40 cents a pound is quoted f. o. b. works for ash packed in bags. Caustic soda holds to a price level of 2.60 cents per pound for the solid product f. o. b. works, and bleaching powder is 1.90 to 2.10 cents a pound at producing points.

◆ Old Paper

The price situation in waste paper is little short of distressing from the dealers' point of view and insofar as the low quality grades are concerned. Surplus supply and cautious buying by board manufacturers owing to the weakening trend of the market has sent values tumbling down, and prices are now lower than have been recorded in a lengthy time. Old No. 1 mixed paper is selling in the East at 20 cents per hundred pounds f. o. b. New York, and folded news at 30 cents, and it is not denied that some sales have been made at even under these prices. Market rates in the Middle West are 35 cents a hundred for mixed paper and 45 cents for folded newspapers f. o. b. shipping points. Other grades have slipped off further in value also. There is slack demand for book stock, and No. 1 heavy books and magazines are reported offered in the East at 65 to 70 cents per hundred pounds at dealers' points, while No. 1 old kraft paper is down to one cent a pound at shipping points, soft white shavings at 1.85 cents a pound, No. 1 hard white shavings at 2.15 to 2.25 cents, and white news cuttings at 1.10 cents. Two descriptions stand out in the current market; namely, No. 1 hard white envelope cuttings which are bringing 2.75 cents a pound at shipping points, and white ledger stock, reported commanding 1.40 to 1.50 cents per pound.



NEWER...BETTER Centrifugal Pumps *for Acids and Alkalies*

An additional series of standard and self-priming centrifugal pumps are now manufactured by The Duriron Company for handling corrosive chemicals.

This new line of pumps embody new scientific principles in centrifugal pump design and they are built especially for acid and alkali service. Features of the new line are:

SIMPLIFIED DESIGN
HIGHER EFFICIENCIES
FLATTER PERFORMANCE CURVES
CLOSED TYPE IMPELLERS
LOWER PRICES

. . . . . and some of the models can be converted from standard types to self-priming types by the changing of the cover and the adding of an air separator.

The new line of pumps is available in any one of several different alloys: Duriron; Durichlor; Durimet; Durco Alloy Steels; Alcumite; Hard Lead.

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SILICATE of SODA

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Import and Export MARKETS

IMPORTS

◆ Wood Pulp

Activity in imported wood pulp has slowed down but in spite of this the markets abroad exhibit decided firmness of tone and producers are not pressing to sell nor do they show any inclination to consider price concessions. Prices are well maintained on practically all kinds of foreign pulp, and from all indications the market is in a healthy statistical condition, mills in Europe apparently being well sold up for the remainder of this year and some well into 1935.

There is, of course, business transpiring in pulp right along, some paper and board manufacturers buying in fairly consistent fashion and in the aggregate placing orders or contracts for a moderately large tonnage of the several classes of chemical pulp. However, demand has let down to a substantial degree in recent weeks. One reason would appear to be the season of the year, this being the time when consumers are not very eager to buy while facing the summer and its customary dullness in their own markets. Another is that business in paper and board has quieted to some extent, with the result numerous manufacturers find themselves with ample supplies of pulp on hand or on order, and are waiting for matters in their own markets to become clarified before purchasing additional raw material. Still another reason, it would seem, is the general uncertainty now existing—the slowing down of business in nearly all lines, the irregular trend in prices of major commodities, the inability of manufacturers to determine with any degree of accuracy what their forward requirements are likely to be.

Members of the trade speak very confidently concerning the outlook in pulp. Many are sincerely of the belief higher prices will be witnessed later this year, this belief being based on the theory that with producing mills well sold up and some fully sold for the balance of the year, an advancing market will develop should consumption move ahead further and a tighter supply situation be created. Opinion seems unanimous that no lower market prices than now prevail will be seen, since it is held that present prices allow but limited margin of profit to produeers.

Most of the current demand for foreign pulp is for strong unbleached sulphite and for kraft pulp. Consumers are more or less neglecting bleached sulphite, and the explanation is that many are buying unbleached sulphite and doing their own bleaching, since they find this is more economical. It is even reported that some paper mills are offering bleached sulphite for re-sale, evidently having a surplus supply over their present needs, and that re-sale lots of such pulp are to be had at prices constituting some recession from cost and below present replacement prices.

Bleached sulphite is quoted at 2.75 cents upwards per pound ex dock American Atlantic seaboard, depending on grade, with some mill brands 3 cents and higher, while prime strong unbleached sulphite is 2.10 to 2.20 cents ex dock, according to grade; easy bleaching and Mitscherlich sulphites 2.25 to 2.30 cents, and prime Swedish kraft pulp 1.85 to 2 cents. Foreign groundwood of Scandinavian origin is quoted around $26.50 per ton for dry pulp ex dock Atlantic seaboard, and a dollar or so per ton less for moist.

Importations of chemical pulp into the United States decreased in March compared with the preceding month, reaching a total of 97,694 long tons of a value of $4,241,737, against 128,708 tons of a value of $5,003,543 in February last, and 70,467 tons of a declared value of $2,657,488 in March a year ago, according to U. S. Department of Commerce figures. The March receipts brought the total for the first quarter of this year up to 351,313 long tons of chemical pulp, contrasted with 282,439 tons in the similar period of 1933. Groundwood imports in March amounted to 8,249 long tons, valued at $154,994, compared with 10,186 tons of a value of $187,360 in the month before, and making a total for the first three months of this year of 31,573 long tons, valued at $557,367, against 20,418 tons of a value of $353,604 in the same time last year.

◆ Paper Stock

Papermaking rag imports into the United States in March last amounted to 8,677,247 pounds, valued at $11,242, compared with 9,782,416 pounds of a value of $104,727 in the preceding month, and making a total for the first quarter of the current year of 22,013,734 pounds of a declared value of $279,620, against 13,271,698 pounds of a value of $111,479 in the corresponding time last year, according to U. S. Department of Commerce statistics. Imports of miscellaneous paper stock, comprising old rope, bagging, waste paper, etc., in March were 6,514,020 pounds, valued at $85,294, against 4,509,740 pounds of a value of $72,583 in the month before, and bringing the total for the first three months of the year up to 15,461,094 pounds of a value of $232,814, contrasted with 16,354,590 pounds of a value of $156,849 in the similar period a year ago.

◆ Paper

Paper imports into the United States scored a gain in value during March as compared with the preceding month, totaling $6,665,375, according to U. S. Department of Commerce official figures, contrasted with imports of a value of $5,129,203 in February this year, and $5,235,529 in March last year. The March imports made a total for the first quarter of the current year of $18,377,555, compared with $15,458,579 in the similar time last year. Newsprint comprised the major portion of imports in March last, amounting to $5,721,529, while imports of cigarette paper, next in importance, reached a value of $374,171 in the same month. Newsprint imports in the three-month period were valued at a total of $15,736,612, against $13,689,557 in the same period last year.

EXPORTS

The United States increased its export trade in paper and paper manufactures to at least a slight extent, in point of value, during March last as compared with the preceding month and also as compared with the same month a year ago. The March exports reached a total value of $1,631,808, contrasted with shipments of an aggregate value of $1,362,409 in February this year and $1,193,415 in March, 1933, according to figures issued by the U. S. Department of Commerce. The value of exports in the first quarter of the current year totaled $4,494,992, showing an increase over shipments of a value of $3,256,501 in the similar period last year.

Exports of newsprint in March last amounted to 5,155,491 pounds of a value of $109,322, against 5,079,966 pounds of a value of $72,157 in the same month last year. Shipments of uncoated book paper reached a total value of $59,347 in March, compared with $96,025 in March a year ago, while exports of wrapping paper were valued at $153,571, against $125,098 a year ago; of writing paper $112,901, against $83,254; of tissue and crepe paper $52,381, against $23,089; of toilet paper $62,402, against $46,936; of sheathing and building paper $14,441, against $7,403; of blotting paper $27,159, against $14,593.

Exports of boxboard were valued at $56,993 in March, compared with $37,454 a year ago, and of other paperboard at $90,798, against $52,039. Paper bag exports reached a value of $70,578, against $41,820 last year, and paper boxes, $36,071, against $40,354. Old and overissue newspapers were exported to the value of $168,438 in March, contrasted with $52,809 last year.

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